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ABSTRACT

A competency-based automotive mechanics curriculum was developed at Big Bend Community College (Washington) in order to provide the basis for an advanced placement procedure for high school graduates and experienced adults through a competency assessment. In order to create the curriculum, Big Bend Community College automotive mechanics instructors, in conjunction with the joint advisory committee and Moses Lake High School automotive mechanics instructors, reviewed exemplary curricula, compiled competency lists, and had competencies rated and varified by advisory committee members. The final curriculum consists of six modules. An assessment form and procedures for advanced placement for students and adults also was developed. (Most of this document consists of a section of student learning objectives and an automotive mechanics competency-based curriculum handbook. The objectives are divided into first-year and second-year programs and cover the subjects of the modules. The curriculum handbook explains the procedure for advanced placement, and provides an automotive mechanics assessment form and a list of competencies. It contains six competency modules that cover the following topics: shop skills and safety; engine service; brakes, suspension, and steering; electrical systems; fuel system; and power trains. Each competency module contains a list of tasks, a performance objective, and enabling objectives that show successful performance of the task.) (KC)

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FINAL REPORT

Project No. 85-AXC(034)NB

ED269629

# Development of Competency-Based Articulated Automotive Program Big Bend Community College and Area High Schools

Curriculum Development Project
Conducted Under
Public Law 94-482

Nancy A. Maxwell, Project Director
Fred Buche and Charles Cox, Principal Investigators
Big Bend Community College
28th and Chanute
Moses Lake, Washington 98837

April 18, 1986

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The project reported herein was performed pursuant to a grant from the Research Coordinating Unit of the Washington State Commission for Vocational Education. All materials developed through this contract must comply with non-discrimination and sex equity policies. Contractors undertaking projects under Commission for Vocational Education sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Commission position or policy.

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April 18, 1986

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DEVELOPMENT OF COMPETENCY-BASED ARTICULATED AUTOMOTIVE PROGRAM
BIG BEND COMMUNITY COLLEGE AND AREA HIGH SCHOOLS

## I. Project Summary

The purpose of this project was to develop a competency-based automotive mechanics curriculum at Big Bend Community College. This competency-based program will provide the basis for an advanced placement procedure for high school graduates and experienced adults through a competency assessment. An advanced placement process will be strengthened by articulation agreements with each individual high school interested in participating.

The competency-based curriculum was developed by Big Bend Community College Automotive Mechanics instructors in consultation with the joint advisory committee for the Big Bend Community College and Moses Lake High School Automotive Mechanics program.

Exemplary automotive curriculums were reviewed. Competency lists were compiled by the instructors. Advisory committee members rated and verified the competencies for inclusion in the curriculum. Instructors refined and developed the final curriculum consisting of six modules including competencies, tasks, performance objective and enabling objectives for each task.

An assessment form and procedure was developed for advanced placement for high school students enrolled in automotive courses and adults who have gained skills from prior experience.

Articulation agreements will be developed with each high school based on individual programs. Agreements will include student and instructor responsibilities, modules/courses to be considered for advanced placement and procedures for assessment and advanced placement.

This project has produced a competency-based automotive mechanics curriculum with the potential for advanced placement for high school graduates and experienced adults who are interested in continuing their education at Big Bend Community College. The project director and principal investigators are proud of the results and are pleased to share this final report and curriculum.

## II. Problem Statement

Big Bend Community College offers a two-year automotive mechanics program and administers a secondary automotive program in cooperation with Moses Lake High School. The two programs share the same building on the Big Bend Community College campus. After one or two years of the high school program the students have some valuable basic automotive mechanics skills. However, when the students enter the two-year community college program, they must repeat portions of the basic content courses. Likewise, adults who have received training as an apprentice in the shop or through military training also must enroll in the beginning courses. Some opportunity for advanced placement based on assessment of prior experience could encourage more high school students and experienced adults to continue their automotive training at Big Bend Community College. A competency based and articulated community college automotive curriculum would provide an opportunity to:

(1) Assess prior experience based on specfic competencies and

(2) Advance place students within the two-year curriculum.

## III. Project Goals and Objectives

The goals of the project were to:

(1) Develop an articulated competency based automotive mechanics curriculum at Big Bend Community College in cooperation with the Moses Lake High School program and other area high schools

(2) Enroll 10-15 advanced placement students from high school or trade/industry/military experience during 1986-87.

## IV. Project Design and Methodology

The project director and principal investigators reviewed exemplary competency-based and articulated automotive programs identified in a literature search in ERIC, Curriculum Management Centers, National Postsecondary Alliance, and National Center for Research in Vocational Education. These materials were compared with the current Big Bend Community College automotive mechanics program.

A composite list of the main content and skill areas was compiled from the literature search and the current BBCC automotive mechanics program. This list was organized in a card sort procedure for presentation to the joint Big Bend Community College/Moses Lake High School Automotive Advisory Committee.

The Advisory Committee rated the content and skill areas for inclusion in the preparatory automotive program based on importance and recommended level for instruction, e.g. secondary, first year or second year community college curriculum or in continuing education. The Advisory Committee also grouped the content areas into recommended courses. Advisory committee members added skills and content areas that they felt should be included but had not surfaced in the literature search.

The automotive instructors summarized the ratings and skill area lists. Modules and competency lists were developed from the selected curriculum materials, Advisory Committee input and current course outlines. These modules were presented to the Advisory Committee for verification and revision. Few additional recommendations were given by the Advisory Committee. Using the refined and verified competency lists, the automotive mechanics instructors developed the competency based curriculum in six modules identifying the competency/task, performance objectives and enabling objectives for each competency/task. These modules were organized in a handbook for reference for instructors, secondary teachers, experienced adults seeking advance placement for entry into the community college automotive program.

An Automotive Mechanics Competency Assessment form was developed for recording and assessing level of competency for advanced placement. A procedure was developed and outlined for awarding advanced placement to current high school automotive students and adults gaining skills from prior experience.

The secondary automotive instructors were concurrently developing the Student Learning Objectives (SLO) for the secondary program. Since the secondary program serves the function of career exploration as well as entry level skill training, the depth of instruction limits the competency level achievement in some of the courses. The Advisory Committee advised continuing recognition of the multiple goals of the secondary program and recommended that the secondary instructors not design the program only as a feeder to the community college program. Thus the SLOs reflected the broad scope of the secondary program. The Advisory Committee had recommended that consideration be given to advanced placement for a portion of the first quarter of the community college program.

## V. Results and Accomplishments

This project provided the opportunity to revise the Big Bend Community College Automotive Mechanics program to a competency based program and assessment for advanced placement for high school automotive students and adults who have gained skills through prior experience. The curriculum is comprised of six modules each containing the competencies/tasks required, performance objectives and enabling objectives. A competency assessment form and procedure for advanced placement has been developed for Big Bend Community College.

The Student Learning Objectives for the Moses Lake High School Automotive Program have been defined. Since each secondary program is unique in its program content and emphasis, a separate articulation agreement will be developed with each high school as needed.

Plans are in place for promoting the advanced placement opportunity and assessment procedure with each of the area high schools offering automotive programs. A promotion campaign will be implemented to inform adults in the area of the advanced placement through assessment of prior experience. The second goal of enrolling 10-15 advanced placement students during 1986-87 will be evaluated next year.

## VI. Evaluation

The project director and principal investigators are proud of the results of this curriculum development project. The process of identifying, verifying, and organizing the competencies has strengthened the focus of the Big Bend Community College Automotive Mechanics program. After reviewing numerous competency based curriculums, the principal investigators determined that none were appropriate for adoption at Big Bend Community College. This reinforced the value of an instructor/program advisory committee developed program. The development process could have been more efficient if a clear model or format for the final product had been developed early in the project by the project director and principal investigators. A lot of time was invested in developing a workable format for the curriculum.

The projected time line for development and implementation was too optimistic. Curriculum development is a very time intensive activity when instructors are teaching full-time loads.

The advanced placement concept remains a challenging opportunity in block time vocational programs. Scheduling courses in three-hour blocks does not allow easy advanced placement for portions of courses. This aspect will need continued and creative efforts. To date, students will not be allowed to advance place out of portions of courses. However, some alternate assignments may be designed for experienced students.

The diversity of secondary programs necessitated the provision for individuals articulation agreements with each high school rather than a blanket agreement.

This project has produced a valuable curriculum. The process of curriculum development has strengthened the skills and relationships of the instructors. Students will be the benefactors of improved instruction.

## VII. Conclusions and Implications

As a result of this curriculum development project, Big Bend Community College has produced an excellent competency-based curriculum for implementation in the 1986-87 academic year. The competency-based curriculum has expanded the opportunities for advanced placement for high school graduates who have completed automotive courses, and adults who have gained skills through prior experiences. A procedure for assessment of prior experience has been developed.

This project further identified the need for annual promotion and review with secondary vocational program counterparts. The articulation agreements developed will need to be reviewed and evaluated each year.

The following implications and issues were identified through this project:

1. Block time vocational program scheduling limits the flexibility for advanced placements.

2. The time and procedure required for assessment of an adult with prior experience will need to be evaluated during the next two years.

3. Release time is needed for instructors involved in intensive curriculum development and revision.

4. Cooperation, coordination, and confidence between secondary and community college instructors will be essential for the success of an articulated competency-based program and advanced placement for high school program completers.

## VIII. Project Dissemination

The results of this curriculum development project will be disseminated to the following organizations and institutions:

1. Commission for Vocational Education

2. ERIC

3. Curriculum Management Centers

4. National Center for Research in Vocational Education

5. National Postsecondary Alliance

6. Washington Vocational Director's Council (secondary and community college)

7. Community College Automotive Instructors

8. Big Bend Community College service area high school vocational directors and automotive instructors.

# APPENDIX A

## STUDENT LEARNING OBJECTIVES

Moses Lake High School

Big Bend Community College

BIG BEND COMMUNITY COLLEGE
AREA VOCATIONAL CENTER
HIGH SCHOOL AUTO MECHANICS

STUDENT LEARNING OBJECTIVES
FIRST YEAR

## AUTO SHOP SAFETY

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

1. PASS THE SAFETY TEST WITH 100% ACCURACY BEFORE HE/SHE WILL BE ALLOWED TO WORK IN THE SHOP AREA
2. DISPLAY THE PROPER PROCEDURE FOR RAISING A CAR WITH A HYDRAULIC FLOOR JACK AND PROPERLY SUPPORTING IT WITH JACK STANDS
3. POSITION THE SADDLES AND RAISE A CAR PROPERLY AND SAFELY ON THE SINGLE POST HYDRAULIC HOIST
4. DISPLAY THE PROPER SAFETY PRACTICES IN USING THE VARIOUS AUTOMOTIVE TOOLS WHILE WORKING IN THE SHOP AREA

## AUTOMOTIVE TOOLS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

5. IDENTIFY AND USE 20 OUT OF 25 STANDARD AUTOMOTIVE TOOLS
6. USE THE CORRECT TOOL AS APPLIED TO EACH SPECIFIC FASTENER IN AUTOMOTIVE WORK

## FASTENING DEVICES

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

7. IDENTIFY 20 OUT OF 25 FASTENERS USED IN THE AUTOMOTIVE FIELD
8. APPLY THESE BASIC FASTENERS TO THEIR RESPECTIVE USES IN THE AUTOMOTIVE INDUSTRY
9. DEFINE WHAT THE MARKINGS ON THE TOP OF A BOLT REPRESENT AS RELATED TO TENSIL STRENGTH

## MEASURING INSTRUMENTS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

10. USE BASIC MATH SKILLS TO ACHIEVE DECIMAL EQUIVILENTS IN MICROMETER READINGS

11. READ THE MICROMETER SCALE, ON A WRITTEN TEST, TO THE NEAREST .001 OF AN INCH AT THE 80% ACCURACY LEVEL

12. MEASURE, WITH THE USE OF AN OUTSIDE MICROMETER, A CRANKSHAFT JOURNAL FOR TAPER AND OUT OF ROUND TO THE .001 OF AN INCH

13. MEASURE A CYLINDER BORE, WITH THE USE OF A DIAL BORE GUAGE, FOR TAPER AND OUT OF ROUND. THE RESULTS MUST BE WITHIN .001 OF AN INCH

## ENGINE FUNDAMENTALS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

14. EXPLAIN IN THE PROPER SEQUENCE, THE FOUR STROKES OF AN AUTOMOTIVE ENGINE. STUDENTS WILL BE EXPECTED TO PASS A WRITTEN TEST ON THESE PRINCIPLES WITH 80% ACCURACY

15. DIFFERENTIATE THE FOUR STROKE ENGINE FROM THE TWO STROKE ENGINE

16. IDENTIFY AND EXPLAIN THE OPERATION OF A ROTARY ENGINE

## ENGINE CONSTRUCTION

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

17. MATHEMATICALLY CALCULATE THE CUBIC INCH DISPLACEMENT OF AN AUTOMOTIVE ENGINE, WHEN GIVEN THE BORE AND STROKE, TO THE 80% ACCURACY LEVEL

18. IDENTIFY 16 OUT OF 20 MAJOR PARTS OF AN AUTOMOTIVE ENGINE

19. EXPLAIN THE PURPOSE OF 16 OUT OF 20 MAJOR PARTS OF AN AUTOMOTIVE ENGINE

## ENGINE PISTON RINGS AND PINS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

20. EXPLAIN ON A WRITTEN TEST THE PURPOSES AND USES OF OIL AND COMPRESSION RINGS AS RELATED TO AN AUTOMOTIVE ENGINE

21. IDENTIFY THE DIFFERENCE BETWEEN PRESS FIT TYPE PISTON PINS AND FULL FLOATING TYPE PISTON PINS

ENGINE CRANKSHAFTS AND CAMSHAFTS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

22. EXPLAIN IN WRITING WHY ENGINE BALANCING IS NECESSARY AND HOW THE PROBLEM IS COMPENSATED FOR IN AN AUTOMOTIVE ENGINE

23. EXPLAIN ON A WRITTEN TEST THE FUNCTIONS OF THE CAMSHAFT IN AN AUTOMOTIVE ENGINE

ENGINE BEARINGS AND VALVES

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

24. NAME THE FOUR MOST COMMON METALS USED IN ENGINE BEARING CONSTRUCTION

25. EXPLAIN IN WRITING THE PURPOSES AND FUNCTIONS OF CAM, ROD AND MAIN BEARINGS AS REALATED TO THEIR USES IN AN AUTOMOTIVE ENGINE

26. EXPLAIN IN WRITING THE PROPER SEQUENCE OF EVENTS WHICH OCCUR IN THE VALVE TRAIN OF AN OVERHEAD VALVE ENGINE

27. IDENTIFY THE THREE BASIC TYPES OF CAMSHAFT DRIVES USED IN AUTOMOTIVE ENGINES

28. NAME 8 OUT OF THE 10 MAJOR PARTS OF THE VALVE TRAIN IN A NORMAL OVERHEAD VALVE ENGINE

ENGINE PERFORMANCE

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

29. IDENTIFY VARIOUS FACTORS THAT BOTH CONTRIBUTE TO AND HINDER THE DEVELOPEMENT OF POWER WITHIN AN ENGINE

30. CALCULATE ON A WRITTEN TEST THE COMPRESSION RATIO OF AN ENGINE TO THE NEAREST TENTH

ENGINE LUBRICATION

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

31. COMPLETE AN OIL/OIL FILTER CHANGE ON AN AUTOMOBILE WITHIN A THIRTY MINUTE TIME LIMIT

32. DEFINE OIL VISCOSITY AND HOW IT RELATES TO OIL'S VARIOUS USES

33. EXPLAIN ON A WRITTEN TEST HOW OIL PRESSURE IS CREATED, REGULATED AND MAINTAINED IN AN AUTOMOTIVE ENGINE

34. NAME ON A WRITTEN TEST THE TWO MOST COMMON PLACES WHERE LOSS OIL PRESSURE OCCURS

35. DRAW A SERIES OF OIL GALLERIES TO SHOW HOW OIL IS DISTRIBUTED TO THE VARIOUS PARTS OF AN ENGINE

ENGINE COOLING SYSTEMS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

36. CHECK FOR THE PROPER LEVEL OF COOLANT IN AN AUTOMOTIVE COOLING SYSTEM

37. CHECK THE FREEZING POINT OF THE COOLANT IN AN AUTOMOTIVE COOLING SYSTEM

38. IDENTIFY AND EXPLAIN ON A WRITTEN TEST THE PURPOSES OF FOUR OUT OF THE FIVE MAJOR PARTS IN AN AUTOMOTIVE COOLING SYSTEM

39. DIFFERENTIATE BETWEEN AN AIR COOLED AND A LIQUID COOLED ENGINE

40. CHECK WITH CONFIDENCE THE COOLANT HOSES AND FAN BELTS FOR DEFECTS OR WEAR WHICH WILL REQUIRE THEM TO BE REPLACED

OTHER ENGINES

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

41. IDENTIFY USES AND DESIGNS FOR FOUR ENGINES OTHER THAN THE NORMAL FOUR STROKE ENGINE THAT IS USED IN THE AUTOMOBILE

## ENGINE RECONDITIONING

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

42. EXPLAIN THE PROPER PROCEDURE FOR CLEANING AN ENGINE WHEN PREPARING IT FOR RECONDITIONING

43. CHECK AN ENGINE FOR WEAR, CRACKS AND WARPAGE

44. EXPLAIN IN WRITING TWO DIFFERENT WAYS TO REPAIR A DAMAGED CYLINDER WALL

45. DEFINE THE NORMAL WEAR LIMITS IN RELATIONSHIP TO THE PISTONS, CRANKSHAFT AND CYLINDERS IN AN AUTOMOBILE ENGINE

46. REPEAT SLO # 20 ON ENGINE BALANCING

## PISTON RING AND PIN FITTING

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

47. MEASURE THE END GAP AND SIDE CLEARANCE OF A SINGLE RING IN AN ENGINE TO THE NEAREST .001 OF AN INCH

48. REPEAT SLO # 21 ON PISTON PIN TYPES

## CRANKSHAFTS, CAMSHAFTS AND CONNECTING ROD SERVICE

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

49. LIST TWO WAYS BEARING CLEARANCES CAN BE MEASURED WHEN ASSEMBLING AN ENGINE

50. DEFINE BEARING CRUSH AND LIST TWO REASONS FOR IT

51. LIST THREE PRECAUTIONS OR PROCEDURES OF INSTALLATION FOR MAIN, ROD AND CAM BEARINGS

## VALVE SERVICE

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

52. LIST THE WEAR LIMITS IN REGARD TO THE VALVE STEM, MARGIN, GUIDE, SEAT AND SPRING IN A CYLINDER HEAD

53. LIST THREE FACTORS THAT CONTRIBUTE TO PREMATURE VALVE FAILURE

54. EXPLAIN ON A WRITTEN TEST THE OPERATION OF A HYDRAULIC VALVE LIFTER

55. WHEN GIVEN SHOP EQUIPMENT, GRIND A VALVE AND VALVE SEAT TO COMPLY TO MANUFACTURES SPECIFICATIONS

ENGINE TROUBLESHOOTING

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

56. LIST THE PROCEDURES FOR FINDING THE CAUSE OR CAUSES OF LOW OIL PRESSURE IN AN AUTOMOTIVE ENGINE

57. LIST THE PROCEDURES FOR TROUBLESHOOTING THE COOLING SYSTEM OF AN AUTOMOBILE

58. LIST FIVE POSSIBLE SOURCES OF A KNOCKING SOUND WITHIN AN ENGINE

ENGINE TUNE UP

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

59. LIST FIVE TESTERS USED IN THE DIAGNOSIS OF THE ELECTRICAL SYSTEM OF AN AUTOMOBILE AND EXPLAIN THE FUNCTIONS OF EACH

60. WHEN GIVEN SHOP EQUIPMENT, TUNE UP AN AUTOMOBILE ENGINE. THIS INCLUDES CHANGING AND ADJUSTING THE POINTS, CONDENSER AND SPARK PLUGS IN A FOUR, SIX OR EIGHT CYLINDER ENGINE

61. DISPLAY THE PROPER TECHNIQUE FOR CHECKING COMPRESSION IN AN AUTOMOBILE ENGINE

62. LIST SIX SYSTEMS OR CONTROLS ON AN AUTOMOBILE THAT ARE DESIGNED TO REDUCE EXHAUST EMISSIONS

SPRING SUSPENSION AND STEERING

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

63. LIST TWO DIFFERENT TYPES OF SUSPENSION SYSTEMS FOR BOTH FRONT AND REAR SUSPENSION UNITS

64. DEFINE THE PURPOSE AND DESIGN OF A STANDARD SHOCK ABSORBER

65. IDENTIFY ON A PICTURIZED TEST SIX MAJOR PARTS OF A STEERING MECHANISM

## WHEEL ALIGNMENT AND CORRECTION

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

66. DEFINE ON A WRITTEN TEST THE TERMS; CASTER, CAMBER, TOE-IN AND TOE-OUT

67. IDENTIFY THE EQUIPMENT NECESSARY TO RETURN FRONT END ALIGNMENT TO WITHIN MANUFACTURES SPECIFICATIONS

## AUTOMOTIVE BRAKES

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

68. DESCRIBE THE PROPER PROCEDURE ON A WRITTEN TEST FOR DEALING WITH BRAKE DUST. BRAKE DUST CONTAINS ASBESTOS FIBER AND ASBESTOS IS A PROVEN SOURCE OF LUNG CANCER

69. CHECK THE AUTOMOTIVE BRAKE SYSTEM FOR WEAR AND DEFECTS

70. DISPLAY THE PROPER PROCEDURE FOR MAINTAINING A SAFE BRAKE FLUID LEVEL IN AN AUTOMOBILE

71. DEFINE THE PRINCIPLES OF A BASIC HYDRAULIC BRAKE SYSTEM

72. LIST TEN CAUSES AND REMEDIES FOR FAILURES OR DEFECTS WITHIN A HYDRAULIC BRAKE SYSTEM

73. DIFFERENTIATE BETWEEN POWER AND MANUAL HYDRAULIC BRAKE SYSTEMS

74. DEMONSTRATE THE PROCEDURE FOR ADJUSTING AND REPACKING THE THE FRONT WHEEL BEARINGS WITH GREASE ON A TYPICAL REAR WHEEL DRIVE AUTOMOBILE

## CLUTCHES

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

75. DESCRIBE THE PROPER PROCEDURE ON A WRITTEN TEST FOR DEALING WITH CLUTCH DUST. CLUTCH DUST CONTAINS ASBESTOS FIBER AND ASBESTOS IS A PROVEN SOURCE OF LUNG CANCER

76. LIST SIX COMMON CLUTCH PROBLEMS AND TWO CAUSES FOR EACH ONE OF THEM

77. IDENTIFY AND DEFINE ON A WRITTEN TEST THE FUNCTION OF FOUR MAJOR COMPONENTS IN A CLUTCH SYSTEM

## TRANSMISSION FUNDAMENTALS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

78. DIFFERENTIATE BETWEEN A MANUALTRANSMISSION AND AN AUTOMATIC TRANSMISSION

79. EXPLAIN ON A WRITTEN TEST THE BASIC PRINCIPLES OF OPERATION FOR BOTH A MANUAL TRANSMISSION AND AN AUTOMATIC TRANSMISSION

80. CHECK THE FLUID LEVEL FOR BOTH A MANUAL TRANSMISSION AND AN AUTOMATIC TRANSMISSION

## DRIVE LINE SERVICE

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

81. DEFINE THE PURPOSES AND FUNCTIONS A U-JOINT PERFORMS IN A DRIVE SHAFT

82. CHECK THE U-JOINTS OF A DRIVE SHAFT FOR DEFECTS

83. MAINTAIN THE FLUID LEVELS OF THE VARIOUS DRIVE TRAIN UNITS

84. DEFINE THE PRINCIPLES OF OPERATION OF A DIFFERENTIAL UNIT

## AUTOMOBILE AIR CONDITIONING

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

85. DEMONSTRATE THE PROCEDURE FOR RECHARGING AN AUTOMOTIVE AIR CONDITIONING SYSTEM

## TIRE SERVICE

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

86. LIST THE VARIOUS EFFECTS THAT BOTH OVER AND UNDER INFLATION HAVE ON TIRE TREAD WEAR

87. DESCRIBEON A WRITTEN TEST THE DIFFERENCES BETWEEN RADIAL AND BI(..-PLY TIRES

HYDRAULICS AND PNEUMATICS

UPON COMPLETION OF THIS UNIT, STUDENT WILL BE ABLE TO:

88. LIST THREE EXAMPLES OF THE USE OF HYDRAULICS IN THE AUTOMOTIVE FIELD

89. DEFINEON A WRITTEN TEST PASCAL'S LAW AND RELATE IT TO THE USE OF HYDRAULICS IN THE AUTOMOBILE

Mike O'Konek
Instructor

BIG BEND COMMUNITY COLLEGE

AUTOMOTIVE MECHANIC'S PROGRAM FOR HIGH SCHOOL STUDENTS

SECOND YEAR OBJECTIVES

I. Fundamentals of Electricity and Magnetism

Upon completion of this unit, the student will be able:

1. To complete in writing a description of how electricity serves the automobile engine in operation, describing the ten main components required for service.

2. To trouble shoot a typical auto ignition circuit, restoring the automobile to running condition given a tachometer, dwell meter and ohmmeter.

3. To describe in a written test the organization of sub-atomic particles as they relate to the atoms structure at the 80% accuracy level.

4. To construct a working 12-volt automotive D.C. circuit, given a switch, a resistor, a lamp and wire.

5. To draw series, series/parallel and parallel circuits at the 80% accuracy level, given 10 automotive electrical symbols.

6. To describe, using a blackboard, how to find the unknown factor using Ohm's Law, given two of the three formulated components.

7. To apply to 80% accuracy, the "left hand rule of thumb" to find the direction of magnetic lines of force, given a conductor and its direction of current flow.

II. Storage Batteries

Upon completion of this unit, the student will be able:

1. To differentiate in writing between a dry and wet cell battery listing eight out of the ten differences in battery construction.

2. To compare the materials used in positive and negative plate groups to the 80% level of accuracy, given a matching test.

3. Given shop equipment, the student will be able to recharge an automotive 12-volt battery, reaching a specific gravity level of 1.250 minimum.

4. To demonstrate correct safety procedures used when removing and transporting a battery; given a battery strap, terminal puller, and project car as demonstrated in class.

5. To describe in writing the chemical reactions that take place during charging and discharging a battery, to the 80% level of difficulty; given a multiple choice test.

6. To perform a heavy load test using the variable resistance carbon pile tester and a shop battery as demonstrated in class.

7. To perform a "421" test, given the 421 tester and a solid top shop battery, as demonstrated in class.

III. Engine Ignition

Upon completion of this unit, the student will be able:

1. To identify in writing, eight of the ten components of the "point type" ignition system used in the automobile.

2. To perform a compression test, listing the results on a lab sheet; given a project car, compression gauge and appropriate tools as demonstrated in class.

3. To successfully time a project car given a timing light, as demonstrated in class.

4. To complete a project worksheet on rebuilding an electronic ignition type distributor at the 80% level of correctness.

5. To demonstrate the correct use of the A.C. spark plug cleaning machine to: clean, inspect and gap a plug to a 80% level of proficiency.

IV. Meters, Testers and Analyzers

Upon completion of this unit, the student will be able:

1. To test the resistance of a starter circuit, given a worksheet and shop ohmmeter; to the 80% level of correctness.

2. To successfully use a shop dwell meter to obtain a correct reading of dwell upon a shop project car.

3. To prepare and use the shop tachometer, using a project car, to obtain a reading of engine R.P.M. to the nearest 100 R.P.M. accuracy.

V. Lights, Lighting Circuits, Wiring and Horn

Upon completion of this unit, the student will be able:

1. To demonstrate the use of the head lamp aiming equipment; given a quad head lamp project car and the Hoppy Head Light Aiming Kit, as demonstrated in class.

2. To locate in the motors manual of wiring diagrams a diagram matching an assigned project car as demonstrated in class.

3. To trace an assigned circuit on a diagram, given a motors manual of wiring diagrams to the 80% level of correctness.

4. To find wire sizes of ten unknown project wires, given the American Standard Wire Gauge, to a level of 80% accuracy.

VI. Engine Tune Up

Upon completion of this unit, the student will be able:

1. To perform an engine electrical system check using a N.A.P.A. Engine Analyzer, given the analyzer and check lists demonstrated in lab.

2. To list all the required specifications necessary to tune up a car, given a motors manual and lab sheet, to the 80% level of completeness.

3. To restore a project car to running condition, given a distributor in the hand as demonstrated in class.

4. To rebuild a one barrel carburetor given a carburetor kit, project car, tools and cleaning solution as demonstrated in class.

VII. Electrical Generators and Alternators

Upon completion of this unit, the student will be able:

1. To define, on written test, the principle of electromagnetic induction to an 80% level of correctness.

2. To service the D.C. automotive generator; changing brushes and cleaning the commutator as demonstrated in class.

3. To perform two "in vehicle" A.C. alternator performance tests given lab sheet and test equipment to the 80% level of correctness.

4. To describe on written test, the operating principles of the diode rectifier unit to the 80% level of correctness.

VIII. Generator and Alternator Testing and Servicing

Upon completion of this unit, the student will be able:

1. To test an "A" circuit generator, given a voltmeter and project car as demonstrated in class.

2. To determine the current output of a "B" circuit generator given a 0 to 50 ampre ampmeter, jumper wire and project car, as demonstrated in class.

3. To troubleshoot an alternator rotor given a test lamp, as demonstrated in class.

4. To perform an open circuit stator test given a test lamp, as demonstrated in class.

IX. Generators and Alternators - Regulators and Relays

Upon completion of this unit, the student will be able:

1. To test voltage regulator settings of an "A" circuit Delco-Remy charging system, given a voltmeter and a 1/4 ohm fixed resistance as demonstrated in class.

2. To describe on written test, the operation of the voltage regulator and cut-out relay, to an 80% level of correctness.

3. To test current output of the late model G.M. internal regulator alternator, given the V.A.T. 40 ampmeter and a screwdriver as demonstrated in class.

X. Starting Motor Fundamentals

Upon completion of this unit, the student will be able:

1. To describe, via oral quiz, the working principle of an overrunning clutch as used in the starter motor to an 80% level of correctness.

2. To list, on written test, 15 of 21 possible starter motor troubleshooting problems.

3. To perform a starter motor stall test, given a shop starter motor, amp meter and carbon pile resistor as demonstrated in class.

4. To probe a starter motor commutator looking for a grounded circuit given an armature and voltmeter as demonstrated in class.

XI. Automotive Fuels

Upon completion of this unit, the student will be able:

1. To define on written test Detonation, Pre ignition and Octane rating to an 80% level of correctness.

2. To explain on written test the concept of fuel volitility to an 80% level of correctness.

3. To list on written test five out of seven common alternative fuels to gasoline, and describing the advantages of each fuel to an 80% level of correctness.

XII. Fuel Supply Systems

Upon completion of this unit, the student will be able:

1. To describe, on written exam, fuel pump operation to an 80% level of correctness; given a cross sectional diagram of a fuel pump with eight labeled parts.

2. To demonstrate how to check for a defective fuel pump; given a pressure/vacuum gauge and project car as demonstrated in class.

3. To describe, on written exam, the operating principle of a positive displacement "roots" type supercharger to an 80% level of correctness.

4. To describe, on written exam, the advantages of an exhaust driven turbocharger to an 80% level of correctness.

XIII. Fuel Injection

Upon completion of this unit, the student will be able:

1. To contrast on written exam, a diesel fuel injection system to a mechanical type gasoline fuel injection system, to an 80% level of correctness.

2. To list on written exam, the advantages of gasoline fuel injection as a method of fuel delivery over carburetion, to an 80% level of correctness.

3. To describe on written exam, the principle of electronic fuel injection to an 80% level of correctness.

XIV. Principles of Carburetion

Upon completion of this unit, the student will be able:

1. To define, on written exam, how the terms: Air-fuel ratio, evaporation, atomization and venturi pertain to the automobile to an 80% level of correctness.

2. To identify in lab, the major parts and circuits of a two barrel carburetor as demonstrated in class, to an 80% level of correctness given a disassembled carburetor and carburetor board.

3. To demonstrate the procedure used to adjust idle mixture screws, curb idle, and fast idle; to an 80% level of correctness given specifications from an approved auto service manual on a project car.

4. To rebuild a single barrel Holley carburetor to working condition; as demonstrated in lab, given a project carburetor, carburetor cleaner solution and a repair kit.

XV. Manual and Automotive Chokes

Upon completion of this unit, the student will be able:

1. To explain, on written exam, the operating principle of the choke system to an 80% level of correctness.

2. To adjust choke settings to seasonal requirements, given a project car, and appropriate tools as demonstrated in lab.

John Collins
Instructor

# A P P E N D I X  B

## AUTOMOTIVE MECHANICS COMPETENCY-BASED CURRICULUM HANDBOOK

Big Bend Community College

## FOREWORD

This competency based Automotive Mechanics curriculum was developed to provide improved instruction to Big Bend Community College students and to provide a procedure for advanced placement for students who have gained skills through prior experiences. The advanced placement process is focused on two potential audiences:

1. Current high school students enrolled in secondary automotive programs and

2. Adults who have gained skills from prior experiences, e.g. military, apprenticeships, work experience or other training.

This handbook contains the procedure for competency assessment and awarding advanced placement, Automotive Mechanics Competency Assessment Forms, list of competencies, and the six modules identifying the performance objectives for each competency.

This curriculum was developed through a grant from the Research Coordinating Unit of the Washington State Commission for Vocational Education.

We are pleased to share this curriculum. The development of the competency based curriculum has been a growing experience for all involved. Since curricula and teaching are dynamic processes, this document will always be a working draft. Please feel free to contact us for more information or with suggestions for improvement.

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Big Bend Community College
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4/86

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BIG BEND COMMUNITY COLLEGE
Automotive Mechanics
Procedure For Advanced Placement

This project has provided an opportunity for advanced placement for two target groups of potential students in Automotive Mechanics at Big Bend Community College.

1. Current high school students enrolled in area secondary automotive mechanics programs who plan to enroll at Big Bend Community College upon high school graduation.

2. Adults with prior experience/training gained through apprenticeships, work experience, military experience or other training.

Big Bend Community College Automotive Mechanics instructors will meet with each area high school to explain the program and provide copies of the modules and the Competency Assessment Forms. An articulation agreement will be developed by the high school and community college instructors and administrators based on the program content of each secondary program. This agreement will include the modules/courses that would be considered for advanced placement, students and instructor's responsibilities, and procedures for advanced placement.

Advanced placement for adults who have gained skills through prior experiences may be awarded advanced placement through an individual assessment with the Automotive Mechanics instructors at Big Bend Community College.

The procedures for each target group of potential students are outlined below.

## High School Student Procedure For Advanced Placement

I. Student and high school instructor will complete the Automotive Mechanics Competency Assessment Form.

II. Student will schedule a meeting with the automotive instructors at Big Bend Community College.

   A. The student should bring the following items to the meeting
      1. Completed assessment file completed by his high school instructor
      2. High school transcript
      3. Letters of recommendation

   B. The BBCC instructor(s) will interview the student and review the assessment file.

   C. The college automotive instructors will determine the level of advanced placement following the interview and assessment review. They may wish to interview references or seek further information as they deem necessary.

III. The student will be notified as soon as possible in regards to the level of advanced placement awarded.

IV. The credits for advanced placement will become a permanent part of the student's transcript as a "pass" grade upon satisfactory completion of the Big Bend Community College automotive mechanics program.

## Adults With Prior Work Experience And/Or Technical Training
## Advanced Placement Procedure

I. Schedule an appointment with BBCC instructor(s) to review the automotive mechanics competency assessment materials and procedure.

II. Complete the automotive mechanics competency assessment form.

III. Compile documentation supporting previous experience and competencies

IV. Schedule an interview with the automotive instructors at Big Bend Community College

A. The student should supply the following:
   1. Completed competency assessment form
   2. Documentation of previous technical training
   3. Documentation of previous work and/or military experience
   4. Current letters of reference or recommendations
   5. Any additional information that may help determine the level of advanced placement

B. BBCC instructors will review file and prior experience with potential student.

C. The college instructors may decide an appropriate written and/or practical test is necessary.
   1. This test will be scheduled at a convenient time
   2. An assessment fee in accordance with current Big Bend Community College procedures will be charged.

D. Credits awarded through advanced placement will become a permanent part of the student's transcript as a "pass" grade upon satisfactory completion of the automotive mechanics program at Big Bend Community College.

These procedures provide persons with educational, trade and/or military experience with the opportunity to shorten their technical program time. It will further allow them the time and opportunity to obtain further math, English, or computer skills that would normally not be possible because of time constraints.

Big Bend Community College

# Automotive Mechanics Assessment Form

Last Name _____ First _____

Address _____ Telephone _____

City, State, Zip _____

High School(s) _____

Instructor(s) _____

## Mechanical Educational Activities and Job Experience

A. List Mechanical Training (schools, seminars, workshops, etc.)

_____

_____

_____

_____

B. List Work Experience (employer, position, dates)

_____

_____

_____

_____

C. List student's career objectives and/or school objectives

_____

_____

_____

_____

## Office Use Only

D. Comments/Recommendations:

_____

_____

_____

_____

# Automotive Mechanics Competencies

**Instructor/Supervisor:** Place your initials and date next to each Duty/Task that this student is able to perform to the level indicated in the modules.

| | Inst. | Date |
|---|---|---|
| **I. Shop Skills & Safety** | | |
| A. Safety | | |
| 1. Apply Shop Safety Rules And Procedures | ____ | ____ |
| 2. Apply Personal Safety Rules And Procedures | ____ | ____ |
| 3. Apply Fire Safety Rules And Procedures | ____ | ____ |
| 4. Apply Electrical Safety Rules And Procedures | ____ | ____ |
| B. Hand Tools | | |
| 1. Identify Snap-Ring Pliers And Their Use | ____ | ____ |
| 2. Identify Screw Drivers, Their Types And Proper Use | ____ | ____ |
| 3. Identify Hammers, Their Types And Proper Use | ____ | ____ |
| 4. Identify Pliers, Their Types And Proper Use | ____ | ____ |
| 5. Identify Wrenches, Their Types And Proper Use | ____ | ____ |
| 6. Identify Socket Wrenches, Types And Proper Use | ____ | ____ |
| 7. Identify Torque Wrenches, Types And Proper Use | ____ | ____ |
| 8. Identify Punches, Types, Care, Safety And Proper Use | ____ | ____ |
| 9. Identify Pullers, Types, Care, Safety And Proper Use | ____ | ____ |
| 10. Identify Chisels, Types, Care, And Their Proper Use | ____ | ____ |
| 11. Identify Hack-Saws, Types, Care And Proper Use | ____ | ____ |
| 12. Identify Files, Types, Care, Safety And Proper Use | ____ | ____ |
| 13. Identify Taps, Types, Care And Proper Use | ____ | ____ |
| 14. Identify Dies, Types, Care And Proper Use | ____ | ____ |
| 15. Identify Stud Removers, Types And Their Use | ____ | ____ |
| 16. Identify Tubing Cutters And Flaring Tools, Types And Their Proper Use | ____ | ____ |
| 17. Identify Easy-Outs And Their Use | ____ | ____ |
| C. Measuring Instruments | | |
| 1. Read A Steel Rule | ____ | ____ |
| 2. Measure Using A Steel Rule And A Caliper | ____ | ____ |
| 3. Read A Feeler Gauge | ____ | ____ |
| 4. Read An Outside Micrometer | ____ | ____ |
| 5. Read An Inside Micrometer | ____ | ____ |
| 6. Read A Dial Indicator | ____ | ____ |
| 7. Identify Vernier Calipers And Their Use | ____ | ____ |
| 8. Identify Depth Gauges And Their Proper Use | ____ | ____ |
| 9. Identify Small Hole Gauges And Their Proper Use | ____ | ____ |
| 10. Identify Telescope Gauges And Their Proper Use | ____ | ____ |
| 11. Identify Shim Stock And Proper Measuring Method | ____ | ____ |
| 12. Identify Plastic-Gauge And Proper Measuring Method | ____ | ____ |
| 13. Identify Thread Gauges And Their Proper Use | ____ | ____ |
| D. Fastening Devices | | |
| 1. Identify Threaded Fasteners By Size, Hardness, And Thread Pitch | ____ | ____ |
| 2. Identify Automotive Fastener Locking Devices | ____ | ____ |
| 3. Identify Various Bolt Head Styles | ____ | ____ |
| 4. Identify Various Automotive Machine Screw Head Styles | ____ | ____ |
| 5. Identify Various Automotive Snap Ring Devices | ____ | ____ |
| **II. Engine Service** | | |
| A. Engine Diagnosis And Testing | | |
| 1. Perform A Cylinder Compression Test | ____ | ____ |
| 2. Perform A Cylinder Power Balance Test | ____ | ____ |
| 3. Perform A Cylinder Leakage Test | ____ | ____ |
| 4. Perform A Manifold Vacuum Test | ____ | ____ |
| 5. Perform A Cooling System Pressure Test | ____ | ____ |
| 6. Perform A Oil Pressure Test | ____ | ____ |
| 7. Test Engine Under Load | ____ | ____ |
| B. Minor Engine Service | | |
| 1. Clean The Outside Of An Engine | ____ | ____ |
| 2. Inspect Engine For Oil Leaks | ____ | ____ |
| 3. Remove And Replace Core Plugs | ____ | ____ |
| 4. Remove And Replace Engine Mounts | ____ | ____ |
| 5. Remove And Replace A Water Pump | ____ | ____ |
| 6. Remove And Replace A Thermostat | ____ | ____ |
| 7. Remove And Replace Timing Gears And Chain | ____ | ____ |
| 8. Remove And Replace Timing Belt | ____ | ____ |
| 9. Adjust Mechanical Valves | ____ | ____ |
| 10. Adjust Hydraulic Valves | ____ | ____ |
| 11. Change Oil And Filter | ____ | ____ |
| C. Major Engine Service | | |
| 1. Remove And Replace Engine Assembly | ____ | ____ |
| 2. Disassemble Engine | ____ | ____ |
| 3. Remove Cylinder Ring Ridge | ____ | ____ |
| 4. Clean Engine Parts And Visually Inspect Their Condition | ____ | ____ |
| 5. Precision Measure Engine Components | ____ | ____ |
| 6. Remove And Replace Pistons, Connecting Rods And Bearings | ____ | ____ |
| 7. Inspect Block For Warpage | ____ | ____ |
| 8. Remove And Replace Crankshaft | ____ | ____ |
| 9. Remove And Replace Cylinder Heads | ____ | ____ |
| 10. Service Valve Guides | ____ | ____ |
| 11. Remove And Replace Camshaft Bearings | ____ | ____ |
| 12. Resurface Valve And Valve Seats And Replace Valve Stem Seals | ____ | ____ |
| **III. Brakes,Suspension And Steering** | | |
| A. Brake Service | | |
| 1. Perform Operational Brake Test | ____ | ____ |
| 2. Perform A Visual Inspection Of All System Components | ____ | ____ |
| 3. Flush Brake System | ____ | ____ |
| 4. Replace Brake Hoses, Control Valves, Lines And Fittings | ____ | ____ |
| 5. Adjust Brake Shoes, Self And Non-Self Adjusting Type | ____ | ____ |
| 6. Remove And Replace Brake Shoes | ____ | ____ |
| 7. Recondition Or Replace Wheel Cylinder | ____ | ____ |
| 8. Machine Brake Drums | ____ | ____ |
| 9. Service/Replace/And/or Adjust Parking Brake Linkage Cables | ____ | ____ |
| 10. Adjust Parking Brake (External Band) | ____ | ____ |
| 11. Service And/or Replace Disc Brake Pads | ____ | ____ |
| 12. Machine Disc Brake Rotors | ____ | ____ |
| 13. Remove And Replace Disc Brake Caliper Assembly And Rotor | ____ | ____ |
| 14. Rebuild Disc Brakes Caliper Assembly | ____ | ____ |
| 15. Remove, Rebuild And Replace Master Cylinder | ____ | ____ |
| 16. Test, Remove, Replace Hydraulic Brake Vacuum Power Units | ____ | ____ |
| 17. Remove And Replace The Porportioning Valve, The Pressure Differential Valve Or The Combination Valve | ____ | ____ |
| 18. Bleed Brake System | ____ | ____ |
| 19. Test Brake Anti-Lock System | ____ | ____ |
| 20. Remove And Replace Anti-Lock System Components | ____ | ____ |
| B. Suspension | | |
| 1. Inspect Suspension System Components | ____ | ____ |
| 2. Remove And Replace Suspension Bushings | ____ | ____ |
| 3. Inspect Tire And Wheel Assembly | ____ | ____ |
| 4. Rotate Tires | ____ | ____ |
| 5. Balance Wheel And Tire Assembly | ____ | ____ |
| 6. Inspect And Service Wheel Bearing And Seal | ____ | ____ |
| 7. Remove And Replace Shock Absorbers | ____ | ____ |
| 8. Remove And Replace Control Arms | ____ | ____ |
| 9. Remove And Replace Ball Joints | ____ | ____ |
| 10. Remove And Replace Torsion Bar(s) | ____ | ____ |
| 11. Remove And Replace Coil Springs | ____ | ____ |
| 12. Remove And Replace King Pin And Bushings | ____ | ____ |
| 13. Remove And Replace Steering Spindle (Ball Joints) | ____ | ____ |

# Automotive Mechanics Competencies

| | Inst. | Date |
|---|---|---|
| 14. Remove And Replace McPherson Strut Assembly | ____ | ____ |
| 15. Rebuild McPherson Strut | ____ | ____ |
| 16. Remove And Replace Leaf Springs | ____ | ____ |
| 17. Lubricate Chassis | ____ | ____ |
| 18. Inspect Twin I Beam And Repair As Needed | ____ | ____ |
| C. Steering System | | |
| 1. Inspect Steering Gear And Linkage | ____ | ____ |
| 2. Service Power Steering Fluid Level | ____ | ____ |
| 3. Lubricate Manual Steering Gear Box | ____ | ____ |
| 4. Adjust Steering Sector (Manual And Power) | ____ | ____ |
| 5. Remove And Replace Steering Components | ____ | ____ |
| 6. Remove And Replace Hydraulic Components In Power Steering Systems | ____ | ____ |
| 7. Remove And Replace Power Steering Belt(s) | ____ | ____ |
| 8. Remove And Replace Power Steering Seals And Boots | ____ | ____ |
| 9. Rebuild Rack And Pinion Manual Assembly | ____ | ____ |
| 10. Align Front End | ____ | ____ |
| 11. Align Rear End | ____ | ____ |
| 12. Remove And Replace Steering Wheel | ____ | ____ |
| **IV. Electrical Systems** | | |
| A. Electrical Theory | | |
| 1. Electron Theory | ____ | ____ |
| 2. Series Circuits | ____ | ____ |
| 3. Parallel Circuits | ____ | ____ |
| 4. Voltage | ____ | ____ |
| 5. Amperage | ____ | ____ |
| 6. Ohm | ____ | ____ |
| B. Batteries | | |
| 1. Visual Inspect Batteries For Servicability | ____ | ____ |
| 2. Inspect Battery Electrolyte Level | ____ | ____ |
| 3. Test Battery With Hydrometer | ____ | ____ |
| 4. Perform Battery Load Test | ____ | ____ |
| 5. Service Or Clean Battery Post, And Cable Connections | ____ | ____ |
| 6. Measure Negative And Positive Voltage Drop | ____ | ____ |
| 7. Remove And Replace Battery Cables | ____ | ____ |
| 8. Charge Battery | ____ | ____ |
| C. Starting System | | |
| 1. Test Starter Control Circuit | ____ | ____ |
| 2. Test Starter Amperage And Voltage Drop | ____ | ____ |
| 3. Remove And/or Replace Starter Solenoid | ____ | ____ |
| 4. Remove And Replace Starter | ____ | ____ |
| 5. Rebuild Starter | ____ | ____ |
| D. Charging System | | |
| 1. Test Alternator Maximum Output | ____ | ____ |
| 2. Test Voltage Regulator Operation | ____ | ____ |
| 3. Remove And Replace Alternator | ____ | ____ |
| 4. Rebuild Alternator | ____ | ____ |
| 5. Remove And Replace Voltage Regulator (Internal And External) | ____ | ____ |
| 6. Inspect, Remove And Repair, And Adjust Alternator Belt | ____ | ____ |
| E. Component Service | | |
| 1. Follow Schematic Diagram | ____ | ____ |
| 2. Identify Wire Gauge And Color Identification | ____ | ____ |
| 3. Splice Wires And Ends | ____ | ____ |
| 4. Isolate Opens, Grounds And Shorts | ____ | ____ |
| 5. Test/Remove/Replace Switches, Circuit Breakers, And Fuses | ____ | ____ |
| 6. Test/Remove/Replace Lights, Sockets, And Connections | ____ | ____ |
| 7. Test And Repair Or Replace Turn Signal Unit | ____ | ____ |
| 8. Adjust Headlights | ____ | ____ |
| 9. Adjust, Repair Or Replace Turn Back-Up Light Circuit | ____ | ____ |
| 10. Test And Repair Horn Circuit | ____ | ____ |
| 11. Repair Or Replace Fuse Block Assembly | ____ | ____ |
| 12. Replace Chassis Wiring | ____ | ____ |
| 13. Test And Replace Gauge And Sending Unit Assembly | ____ | ____ |
| 14. Remove And Replace Electrical Switch | ____ | ____ |
| 15. Test Electrical Components And/or Resistors | ____ | ____ |
| **V. Fuel System** | | |
| A. Fuel Pump | | |
| 1. Test Fuel Pump Volume, Pressure And Vacuum | ____ | ____ |
| 2. Remove And Replace A Fuel Pump | ____ | ____ |
| B. Carburetor | | |
| 1. Inspect, Service And/or Replace Carburetor Air Cleaner | ____ | ____ |
| 2. Inspect, Service And/or Replace A Fuel Filter | ____ | ____ |
| 3. Repair And/or Replace Fuel Lines And Hoses | ____ | ____ |
| 4. Test Engine Vacuum | ____ | ____ |
| 5. Adjust Carburetor Idle Mixture And Speed Using A Tach/dwell Meter | ____ | ____ |
| 6. Remove, Replace And/or Adjust A Carburetor Float | ____ | ____ |
| 7. Remove And Replace A Carburetor | ____ | ____ |
| 8. Rebuild A Carburetor | ____ | ____ |
| 9. Adjust A Carburetor Using An Exhaust Gas Analyzer | ____ | ____ |
| 10. Inspect, Clean And Adjust A Carburetor Choke Assembly | ____ | ____ |
| C. Emmissions Control System | | |
| 1. Test And/or Replace Fuel Lines And Hoses | ____ | ____ |
| 2. Test Automotive Exhaust Emissions | ____ | ____ |
| 3. Adjust Idle Mixture Using The Propane Enrichment Procedure | ____ | ____ |
| 4. Test And/or Repair PCV System | ____ | ____ |
| 5. Test And/or Repair A Thermostatic Air Cleaner System | ____ | ____ |
| 6. Test And/or Repair An Exhaust Gas Recirculation System | ____ | ____ |
| 7. Test And/or Repair An Evaporative Emission Control System | ____ | ____ |
| 8. Test And/or Repair An Air Injection Reactor System | ____ | ____ |
| 9. Test And Adjust An Idle Solenoid | ____ | ____ |
| **VI. Power Trains** | | |
| A. Clutch | | |
| 1. Road Test And Diagnose Clutch | ____ | ____ |
| 2. Adjust Manual Clutch | ____ | ____ |
| 3. Adjust Hydraulic Clutch | ____ | ____ |
| 4. Remove And Replace Clutch Linkage Or Cable | ____ | ____ |
| 5. Remove And Replace Or Rebuild A Slave Or Master Cylinder On Hydraulic Clutch | ____ | ____ |
| 6. Remove And Replace A Clutch Disc And Pressure Plate | ____ | ____ |
| 7. Remove And Replace Clutch Release Bearing (Throw Out Bearing) | ____ | ____ |
| 8. Remove, Replace And Service Pilot Bearing Or Bushing | ____ | ____ |
| 9. Measure Flywheel Runout | ____ | ____ |
| 10. Remove And Replace Flywheel | ____ | ____ |
| 11. Remove And Replace Ring Gear | ____ | ____ |
| B. Manual Transmission | | |
| 1. Diagnose Manual Transmission Problems | ____ | ____ |
| 2. Adjust Shift Linkage | ____ | ____ |
| 3. Remove And Replace Manual Transmission | ____ | ____ |
| 4. Rebuild A Manual Transmission | ____ | ____ |
| 5. Lubricate A Manual Transmission | ____ | ____ |
| 6. Identify Type Of Transmission | ____ | ____ |
| C. Drive Lines | | |
| 1. Perform An Operational Test And Inspect The Drive Line | ____ | ____ |
| 2. Remove And Replace Universal Joints | ____ | ____ |
| 3. Remove And Replace Drive Shaft | ____ | ____ |
| 4. Remove And Replace Center Support And Bearing | ____ | ____ |
| D. Differential | | |
| 1. Service Differential Assembly | ____ | ____ |
| 2. Replace Differential Pinion Seal | ____ | ____ |
| 3. Remove And Replace Axle Seal | ____ | ____ |
| 4. Remove And Replace Axle Bearing | ____ | ____ |
| 5 Rebuild Differential Assembly | ____ | ____ |
| 6. Remove And Replace Final Drive Assembly | ____ | ____ |

# Big Bend Community College

**Each instructor/supervisor should initial on the lines below when evaluating this student.**

## ATTITUDES

| | Needs Improvement | Good | Superior |
|---|---|---|---|
| Works well with others | _____ | _____ | _____ |
| Cooperative | _____ | _____ | _____ |
| Initiative | _____ | _____ | _____ |
| Punctual | _____ | _____ | _____ |
| Manages time well | _____ | _____ | _____ |

Comments: _____

_____

_____

_____

_____

## General Skills

| | Needs Improvement | Good | Superior |
|---|---|---|---|
| Reading Skills | _____ | _____ | _____ |
| Basic Math Skills | _____ | _____ | _____ |
| Writing Skills | _____ | _____ | _____ |
| Use of Reference Materials | _____ | _____ | _____ |
| Test Taking Skills | _____ | _____ | _____ |

Comments: _____

_____

_____

_____

_____

_____

Big Bend Community College
Automotive Mechanics
List of Competencies

I. SHOP SKILLS AND SAFETY

A. Safety
1. Apply Shop Safety Rules And Procedures
2. Apply Personal Safety Rules And Procedures
3. Apply Fire Safety Rules And Procedures
4. Apply Electrical Safety Rules And Procedures

B. Hand Tools
1. Identify Snap-Ring Pliers And Their Use
2. Identify Screw Drivers, Their Types And Proper Use
3. Identify Hammers, Their Types And Proper Use
4. Identify Pliers, Their Types And Proper Use
5. Identify Wrenches, Their Types And Proper Use
6. Identify Socket Wrenches, Types And Proper Use
7. Identify Torque Wrenches, Types, Care And Proper Use
8. Identify Punches, Types, Care, Safety And Proper Use
9. Identify Pullers, Types, Care And Their Proper Use
10. Identify Chisels, Types, Care, Safety And Proper Use
11. Identify Hack-Saws, Types, Care And Proper Use
12. Identify Files, Types, Care, Safety And Proper Use
13. Identify Taps, Types, Care And Proper Use
14. Identify Dies, Types, Care And Proper Use
15. Identify Stud Removers, Types And Their Use
16. Identify Tubing Cutters And Flaring Tools, Types And Their Proper Use
17. Identify Easy-Outs And Their Use

C. Measuring Instruments
1. Read A Steel Rule
2. Measure Using A Steel Rule And A Caliper
3. Read A Feeler Gauge
4. Read An Outside Micrometer
5. Read An Inside Micrometer
6. Read A Dial Indicator
7. Identify Vernier Calipers And Their Use
8. Identify Depth Gauges And Their Proper Use
9. Identify Small Hole Gauges And Their Proper Use
10. Identify Telescope Gauges And Their Proper Use
11. Identify Shim Stock And Proper Measuring Method
12. Identify Plastic-Gauge And Proper Measuring Method
13. Identify Thread Gauges And Their Proper Use

D. Fastening Devices
1. Identify Threaded Fasteners By Size, Hardness, And Thread Pitch
2. Identify Automotive Fastener Locking Devices
3. Identify Various Bolt Head Styles
4. Identify Various Automotive Machine Screw Head Styles
5. Identify Various Automotive Snap Ring Devices

II. ENGINE SERVICE

A. Engine Diagnosing and Testing
1. Perform A Cylinder Compression Test
2. Perform A Cylinder Power Balance Test
3. Perform A Cylinder Leakaage Test
4. Perform A Manifold Vacuum Test
5. Perform A Cooling System Pressure Test
6. Perform An Oil Pressure Test
7. Test Engine Under Load

B. Minor Engine Service
1. Clean The Outside Of An Engine
2. Inspect Engine For Oil Leaks
3. Remove And Replace Core Plugs
4. Remove And Replace Engine Mounts
5. Remove And Replace A Water Pump
6. Remove And Replace A Thermostat
7. Remove And Replace Timing Gears And Chain
8. Remove And Replace Timing Belt
9. Adjust Mechanical Valves
10. Adjust Hydraulic Valves
11. Change Oil And Filter

C. Major Engine Service
1. Remove And Replace Engine Assembly
2. Disassemble Engine
3. Remove Cylinder Ring Ridge
4. Clean Engine Parts And Visually Inspect Their Condition
5. Precision Measure Engine Components
6. Remove And Replace Pistons, Connecting Rods And Bearings
7. Inspect Block For Warpage
8. Remove And Replace Crankshaft
9. Remove And Replace Cylinder Heads
10. Service Valve Guides
11. Remove And Replace Camshaft Bearings
12. Resurface Valve And Valve Seats And Replace Valve Stem Seals

III. BRAKES, SUSPENSION AND STEERING

A. Brake Service
1. Perform Operational Brake Test
2. Perform A Visual Inspection Of All System Components
3. Flush Brake System
4. Replace Brake Hoses, Control Valves, Lines And Fittings
5. Adjust Brake Shoes, Self And Non-self Adjusting Type
6. Remove And Replace Brake Shoes
7. Recondition Or Replace Wheel Cylinder
8. Machine Brake Drums
9. Service/Replace/And/or Adjust Parking Brake Linkage Cables
10. Adjust Parking Brake (External Band)
11. Service And/or Replace Disc Brake Pads
12. Machine Disc Brake Rotors
13. Remove And Replace Disc Brake Caliper Assembly And Rotor
14. Rebuild Disc Brakes Caliper Assembly

15. Remove, Rebuild And Replace Master Cylinder
16. Test, Remove And Replace Hydraulic Brake Vacuum Power Units
17. Remove And Replace The Proportioning Valve, The Pressure Differential Valve Or The Combination Valve
18. Bleed Brake System
19. Test Brake Anti-Lock System
20. Remove And Replace Anti-Lock System Components

B. Suspension
1. Inspect Suspension System Components
2. Remove And Replace Suspension Bushings
3. Inspect Tire And Wheel Assembly
4. Rotate Tires
5. Balance Wheel And Tire Assembly
6. Inspect And Service Wheel Bearing And Seal
7. Remove And Replace Shock Absorbers
8. Remove And Replace Control Arms
9. Remove And Replace Ball Joints
10. Remove And Replace Torsion Bar(s)
11. Remove And Replace Coil Springs
12. Remove And Replace King Pin And Bushings
13. Remove And Replace Steering Spindle (Ball Joints)
14. Remove And Replace McPherson Strut Assembly
15. Rebuild McPherson Strut
16. Remove And Replace Leaf Springs
17. Lubricate Chassis
18. Inspect Twin I Beam And Repair As Needed

C. Steering System
1. Inspect Steering Gear And Linkage
2. Service Power Steering Fluid Level
3. Lubricate Manual Steering Gear Box
4. Adjust Steering Sector (Manual And Power)
5. Remove And Replace Steering Components
6. Remove And Replace Hydraulic Components In Power Steering Systems
7. Remove And Replace Power Steering Belt(s)
8. Remove And Replace Power Steering Seals And Boots
9. Rebuild Rack And Pinion Manual Assembly
10. Align Front End
11. Aligh Rear End
12. Remove And Replace Steering Wheel

## IV. ELECTRICAL SYSTEMS

A. Electrical Theory
1. Electron Theory
2. Series Circuits
3. Parallel Circuits
4. Voltage
5. Amperage
6. Ohm

B. Batteries
1. Visual Inspect Batteries For Servicability
2. Inspect Battery Electrolyte Level
3. Test Battery With Hydrometer

4. Perform Battery Load Test
5. Service Or Clean Battery Post, And Cable Connections
6. Measure Negative And Positive Voltage Drop
7. Remove And Replace Battery Cables
8. Charge Battery

C. Starting System
1. Test Starter Control Circuit
2. Test Starter Amperage And Voltage Drop
3. Remove And/or Replace Starter Solenoid
4. Remove And Replace Starter
5. Rebuild Starter

D. Charging System
1. Test Alternator Maximum Output
2. Test Voltage Regulator Operation
3. Remove And Replace Alternator
4. Rebuild Alternator
5. Remove And Replace Voltage Regulator (Internal And External)
6. Inspect, Remove And Replace, And Adjust Alternator Belt

E. Component Service
1. Follow Schematic Diagram
2. Identify Wire Gauge And Color Identification
3. Splice Wires And Ends
4. Isolate Opens, Grounds And Shorts
5. Test/Remove/Replace Switches, Circuit Breakers, And Fuses
6. Test/Remove/Replace Lights, Sockets, And Connections
7. Test And Repair Or Replace Turn Signal Unit
8. Adjust Headlights
9. Adjust, Repair Or Replace Back-Up Light Circuit
10. Test And Repair Horn Circuit
11. Repair Or Replace Fuse Block Assembly
12. Replace Chassis Wiring
13. Test And Replace Gauge And Sending Unit Assembly
14. Remove And Replace Electrical Switch
15. Test Electrical Components And/or Resistors

V. FUEL SYSTEM

A. Fuel Pump
1. Test Fuel Pump Volume, Pressure And Vacuum
2. Remove And Replace A Fuel Pump

B. Carburetor
1. Inspect, Service And/or Replace Carburetor Air Cleaner
2. Inspect, Service And/or Replace A Fuel Filter
3. Repair And/or Replace Fuel Lines And Hoses
4. Test Engine Vacuum
5. Adjust Carburetor Idle Mixture And Speed Using A Tach/dwell Meter
6. Remove, Replace And/or Adjust A Carburetor Float
7. Remove And Replace A Carburetor
8. Rebuild A Carburetor
9. Adjust Carburetor Using An Exhaust Gas Analyzer
10. Inspect, Clean And Adjust A Carburetor Choke Assembly

C. Emissions Control System
   1. Test And/Or Repair Manifold Heat Riser Assemblies
   2. Test Automotive Exhaust Emissions
   3. Adjust Idle Mixture Using The Propane Enrichment Procedure
   4. Test And/or Repair PCV System
   5. Test And/or Repair A Thermostatic Air Cleaner System
   6. Test And/or Repair An Exhaust Gas Recirculation System
   7. Test And/or Repair An Evaporative Emission Control System
   8. Test And/or Repair An Air Injection Reactor System
   9. Test And Adjust An Idle Solenoid

VI. POWER TRAINS

A. Clutch
   1. Road Test And Diagnose Clutch
   2. Adjust Manual Clutch
   3. Adjust Hydraulic Clutch
   4. Remove And Replace Clutch Linkage Or Cable
   5. Remove And Replace Or Rebuild A Slave Or Master Cylinder On Hydraulic Clutch
   6. Remove And Replace A Clutch Disc And Pressure Plate
   7. Remove And Replace Clutch Release Bearing (Throw Out Bearing)
   8. Remove, Replace And Service Pilot Bearing Or Bushing
   9. Measure Flywheel Runout
   10. Remove And Replace Flywheel
   11. Remove And Replace Ring Gear

B. Manual Transmission
   1. Diagnose Manual Transmission Problems
   2. Adjust Shift Linkage
   3. Remove And Replace Manual Transmission
   4. Rebuild Manual Transmission
   5. Lubricate A Manual Transmission
   6. Identify Type of Transmission

C. Drive Lines
   1. Perform An Operational Test And Inspect The Drive Line
   2. Remove And Replace Universal Joints
   3. Remove And Replace Drive Shaft
   4. Remove And Replace Center Support And Bearing

D. Differential
   1. Service Differential Assembly
   2. Replace Differential Pinion Seal
   3. Remove And Replace Axle Seal
   4. Remove And Replace Axle Bearing
   5. Rebuild Differential Assembly
   6. Remove And Replace Final Drive Assembly

Big Bend Community College
Automotive Mechanics
Competency Modules

I. SHOP SKILLS AND SAFETY

A. Safety

1. Apply Shop Safety Rules And Procedures

2. Apply Personal Safety Rules And Procedures

3. Apply Fire Safety Rules And Procedures

4. Apply Electrical Safety Rules And Procedures

I.A SAFETY

1. TASK: Applying Shop Safety Rules And Procedures

PERFORMANCE OBJECTIVE: Given examples of repair jobs and shop situations, apply shop safety rules and procedures by identifying safe and unsafe shop practices.

ENABLING OBJECTIVES:

1.1 Identify common hazards in the repair shop including
- 1.1.1 Improper use of tools
- 1.1.2 Machinery guards
- 1.1.3 Tripping, slipping and falling hazards
- 1.1.4 Excessive exposure to exhaust gases, chemicals, paints and dust
- 1.1.5 Electrical hazards
- 1.1.6 Improper lifting techniques
- 1.1.7 Eye injuries and the need for eye protection

1.2 Identify and explain potential hazards associated with
- 1.2.1 Asbestos
- 1.2.3 Carbon monoxide
- 1.2.4 Solvents
- 1.2.5 Paints and thinners
- 1.2.6 Cleaning chemicals
- 1.2.7 Hydrogen gas
- 1.2.8 Noise

1.3 Explain safety rules and procedures for using compressed air equipment
- 1.3.1 Explain the importance of good housekeeping in the repair shop
- 1.3.2 Explain safety rules for welding, cutting and brazing
- 1.3.3 Explain the importance of storing materials in a secure manner
- 1.3.4 Identify and explain warning signs posted in the shop area
- 1.3.5 Inspect the repair shop for conformity with safety rules and procedures

2. TASK: Apply Personal Safety Rules And Procedures

PERFORMANCE OBJECTIVE: Given examples of repair jobs and shop situations, practice personal safety procedures.

ENABLING OBJECTIVES:

2.1 Identify types of personal safety equipment and explain their application

2.2 Identify types of repair work that require eye protection

2.3 Identify types of repair work that require hearing protection

2.4 Identify types of repair work that require respirators

2.5 Explain personal safety rules and procedures for welding, cutting and brazing

2.6 Explain the methods for cleaning and storing personal safety equipment
2.7 Explain the reasons for not wearing jewelry in the shop
2.8 Explain the reason for not wearing loose or frayed clothing

3. TASK: Apply Fire Safety Rules And Procedures

PERFORMANCE OBJECTIVE: Given examples of types of fire, fire extinguishers, and shop situations, apply fire safety rules and procedures by identifying safe and unsafe practices.

ENABLING OBJECTIVES:

3.1 Identify and explain the classifications of fires
3.2 Identify and explain the type of fire extinguisher recommended for each class of fire
3.3 Identify common causes of fire in repair shops and methods of avoiding and preventing fires
3.4 Describe procedures for maintaining, selecting and using fire extinguishers
3.5 Inspect the repair shop for conformity with fire safety rules and procedures
3.6 Identify the location of all shop fire extinguishers

4. TASK: Apply Electrical Safety Rules And Procedures

PERFORMANCE OBJECTIVE: Given examples of repair jobs and shop situations, apply electrical safety rules and procedures.

ENABLING OBJECTIVES:

4.1 Describe the proper procedure to connect and disconnect a battery charge
4.2 Describe the proper procedure to remove and replace a battery
4.3 Explain the procedure used to disconnect the battery when working on an electrical component
4.4 Describe the proper procedure to be used when jump-starting a vehicle with a dead battery
4.5 Locate and explain the importance of labeling all circuit breakers
4.6 Explain the importance of grounding all electrical shop equipment
4.7 Explain the methods of using extensive cords and drop lights
4.8 Identify electrical hazards in the shop pertaining to proper maintenance and care of electrical equipment including outlet boxes, cords, connections, switches and insulation.
4.9 Identify approved locations for all electrical equipment and power sources in the repair shop

Big Bend Community College
Automotive Mechanics
Competency Modules

I. SHOP SKILLS AND SAFETY

B. Hand Tools

1. Identify Snap-Ring Pliers And Their Use
2. Identify Screw Drivers, Their Types And Proper Use
3. Identify Hammers, Their Types And Proper Use
4. Identify Pliers, Their Types And Proper Use
5. Identify Wrenches, Their Types And Proper Use
6. Identify Socket Wrenches, Types And Proper Use
7. Identify Torque Wrenches, Types, Care And Proper Use
8. Identify Punches, Types, Care, Safety And Proper Use
9. Identify Pullers, Types, Care And Their Proper Use
10. Identify Chisels, Types, Care, Safety And Proper Use
11. Identify Hack-Saws, Types, Care And Proper Use
12. Identify Files, Types, Care, Safety And Proper Use
13. Identify Taps, Types, Care And Proper Use
14. Identify Dies, Types, Care And Proper Use
15. Identify Stud Removers, Types And Their Use
16. Identify Tubing Cutters And Flaring Tools, Types And Their Proper Use
17. Identify Easy-Outs And Their Use

I.B HAND TOOLS

1. TASK: Identify Snap Ring Pliers And Their Use

PERFORMANCE OBJECTIVE: Given a transmission with a snap ring in place and appropriate snap ring pliers. Demonstrate the proper method of removing the snap ring.

ENABLING OBJECTIVES:

1.1 Identify the different types of snap ring pliers
1.2 Demonstrate the proper use of the snap ring pliers
1.3 Describe the proper method of storage and care of snap ring pliers

2. TASK: Identify Screwdrivers, Their Use And Proper Use

PERFORMANCE OBJECTIVE: Given a project with an assortment of screws in and a selection of screwdrivers, determine the proper driver to use and remove the screws.

ENABLING OBJECTIVES:

2.1 Identify the different types of screwdrivers
2.2 Demonstrate the proper use of the different screwdrivers
2.3 Demonstrate the proper care and sharpening of screwdrivers
2.4 Demonstrate and identify the proper safety procedures when working with screwdrivers

3. TASK: Identify Hammers, Their Types And Proper Use

PERFORMANCE OBJECTIVE: Given a project and a proper hammer, demonstrate the proper use of a hammer.

ENABLING OBJECTIVES:

3.1 Identify the different weights and types of hammers
3.2 Demonstrate the proper use of hammers
3.3 Demonstrate the proper care of hammers
3.4 Demonstrate and identify the proper safety procedures when using a hammer

4. TASK: Identify Pliers, Their Types And Proper Use

PERFORMANCE OBJECTIVE: Given a project and an assortment of pliers, determine the correct plier to use and then complete the assigned task.

ENABLING OBJECTIVES:

4.1 Identify the safety precautions when working with pliers
4.2 Identify the different types of pliers
4.3 Demonstrate the proper use of pliers
4.4 Describe the proper care of pliers

I.B HAND TOOLS

5. TASK: Identify Wrenches, Their Types And Proper Use

PERFORMANCE OBJECTIVE: Given an engine with an assortment of size bolts and an assortment of wrenches, determine the proper wrench to use and remove an assigned unit.

ENABLING OBJECTIVES:

5.1 Safety precautions when working with wrenches
5.2 Identify different types of wrenches
5.3 Demonstrate the proper use of the different wrenches
5.4 Describe the care and maintenance of the different wrenches

6. TASK: Identify Socket Wrenches, Types And Proper Use

PERFORMANCE OBJECTIVE: Given a transmission and an assortment of socket wrenches, determine the proper socket wrenches to use and remove all covers from the transmission.

ENABLING OBJECTIVES:

6.1 Identify the different safety precautions when working with socket wrenches
6.2 Identify different types of socket wrenches
6.3 Demonstrate the proper use of socket wrenches
6.4 Describe the proper care and maintenance of socket wrenches

7. TASK: Identify Torque Wrenches, Types, Care And Proper Use

PERFORMANCE OBJECTIVE: Given an engine and an appropriate torque wrench, torque all main bearings to manufacturer's specification.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions when working with torque wrenches
7.2 Identify different types of torque wrenches
7.3 Demonstrate the proper use of the torque wrench
7.4 Describe the proper care and maintenance of the torque wrench

8. TASK: Identify Punches, Types, Care, Safety And Proper Use

PERFORMANCE OBJECTIVE: Given a unit with a task to be punched out and an assortment of punches, determine the correct punch to use and demonstrate the proper method of removal. Also given a bolt busted off, demonstrate the proper method of center punching the bolt.

I.B HAND TOOLS

ENABLING OBJECTIVES:

8.1 Identify the proper safety precautions when working with punches
8.2 Identify the different type of punches
8.3 Demonstrate the proper use of punches
8.4 Describe the proper care and maintenance of punches

9. TASK: Identify Pullers, Types, Care And Their Proper Use

PERFORMANCE OBJECTIVE: Given a car, steering wheel installed and an assortment of pullers, choose the proper puller and remove the steering wheel.

ENABLING OBJECTIVES:

9.1 Identify the safety precautions in working with pullers
9.2 Identify the different types of pullers
9.3 Demonstrate the proper use of pullers
9.4 Describe the proper care and maintenance of pullers

10. TASK: Identify Chisels, Types, Care, Safety And Proper Use

PERFORMANCE OBJECTIVE: Given an engine with a bolt to be removed with a chisel and an assortment of chisels, determine the correct one to use and remove the bolt.

ENABLING OBJECTIVES:

10.1 Identify the safety precautions when working with chisels
10.2 Identify the different types of chisels
10.3 Demonstrate the proper use of the chisel

11. TASK: Identify Hack-Saws, Types, Care And Proper Use

PERFORMANCE OBJECTIVE: Given a rod to be cut, hack-saw frame and an assortment of blades, determine the proper blade to use and saw the rod in two pieces.

ENABLING OBJECTIVES:

11.1 Identify the different safety precautions when hack-sawing
11.2 Identify the different types of frames and blades
11.3 Demonstrate the proper method and use of the hack-saw
11.4 Describe the proper care and maintenance of the hack-saw

12. TASK: Identify Files, Types, Care, Safety And Proper Use

PERFORMANCE OBJECTIVE: Given an engine to be draw filed and an assortment of files, determine the proper file to use and perform the draw filing to manufacturing specification.

I.B HAND TOOLS

ENABLING OBJECTIVES:

12.1 Identify the safety precautions when working with files
12.2 Identify the different types of files
12.3 Demonstrate the proper method of using a file
12.4 Describe the proper care of a file

13. TASK: Identify Taps, Types, Care And Proper Use

PERFORMANCE OBJECTIVE: Given a piece of metal with a hole drilled in it of proper size and an assortment of taps, select the proper tap and tap the hole to the correct size.

ENABLING OBJECTIVES:

13.1 Identify the proper safety precautions when working with taps
13.2 Identify different types and sizes of taps
13.3 Demonstrate the proper use of the tap
13.4 Describe the proper care of the tap

14. TASK: Identify Dies, Types, Care And Proper Use

PERFORMANCE OBJECTIVE: Given a rod and an assortment of dies and die handle, determine the proper die size and thread the rod.

ENABLING OBJECTIVES:

14.1 Identify safety precautions when working with dies
14.2 Identify the different types and sizes of dies
14.3 Demonstrate the proper use of the dies
14.4 Describe the proper care and maintenance of dies

15. TASK: Identify Stud Removers, Types And Their Use

PERFORMANCE OBJECTIVE: Given an engine with studs in place and a stud remover, demonstrate the proper method to remove the studs.

ENABLING OBJECTIVES:

15.1 Identify the safety precautions when working with stud removers
15.2 Identify the different types of stud removers
15.3 Demonstrate the proper use of stud removers
15.4 Describe the proper care and maintenance

16. TASK: Identify Tubing Cutters And Flaring Tools, Types And Their Proper Use

PERFORMANCE OBJECTIVE: Given a piece of tubing, tubing cutter and flaring tool, cut the tube and make an appropriate flare on the end of the tube.

I.B HAND TOOLS

ENABLING OBJECTIVES:

16.1 Identify the safety precautions when working with tube cutters and flaring tools
16.2 Identify the different types of cutters and flaring tools
16.3 Demonstrate the proper use of the cutter and the flaring tool
16.4 Demonstrate the proper care and maintenance of cutters and
16.5 flaring tools

17. TASK: Identify Easy-Outs And Their Use

PERFORMANCE OBJECTIVE: Given an engine with a broken bolt that has been made ready for the easy-out and an assortment of easy-outs, select the proper easy-out and demonstrate the proper method of removing the bolt.

ENABLING OBJECTIVES:

17.1 Identify the safety precautions when working with easy-out
17.2 Identify the different types of easy-outs
17.3 Demonstrate the proper use of easy-outs
17.4 Describe the proper maintenance and care of easy-outs

Big Bend Community College
Automotive Mechanics
Competency Modules

I. SHOP SKILLS AND SAFETY

C. Measuring Instruments

1. Read A Steel Rule
2. Measure Using A Steel Rule And A Caliper
3. Read A Feeler Gauge
4. Read An Outside Micrometer
5. Read An Inside Micrometer
6. Read A Dial Indicator
7. Identify Vernier Calipers And Their Use
8. Identify Depth Gauges And Their Proper Use
9. Identify Small Hole Gauges And Their Proper Use
10. Identify Telescope Gauges And Their Proper Use
11. Identify Shim Stock And Proper Measuring Method
12. Identify Plastic-Gauge And Proper Measuring Method
13. Identify Thread Gauges And Their Proper Use

## I.C MEASURING INSTRUMENTS

1. TASK: Read A Steel Rule

PERFORMANCE OBJECTIVE: Given a shop rule, and components of various lengths, measure the lengths using a shop rule.

ENABLING OBJECTIVES:

1.1 Explain the importance of accurate measurements when dealing with automotive repairs
1.2 Describe the various scales used on shop rules
1.3 Demonstrate the measurings of components using a shop rule

2. TASK: Measure Using A Steel Rule And A Caliper

PERFORMANCE OBJECTIVE: Given a shop rule, a caliper, and an automotive part requiring measurement with a caliper, measure the clearance with the caliper and then use the shop rule to determine the clearance. When completed, the measurement will be accurate to 1/32 of an inch.

ENABLING OBJECTIVES:

2.1 Explain the importance of accurate measurements when dealing with automotive repairs
2.2 Describe the difference between "direct" and "indirect" reading measurement instruments.
2.3 Describe the different types of calipers
2.4 Demonstrate how to use the caliper
2.5 Demonstrate how to determine the measurement obtained with the caliper

3. TASK: Read A Feeler Gauge

PERFORMANCE OBJECTIVE: Given various automotive components, and feeler gauges measure the clearance using the correct feeler gauge.

ENABLING OBJECTIVES:

3.1 Describe the various types of feeler gauges
3.2 Describe the proper use of each type of feeler gauges
3.3 Describe how to care for feeler gauges
3.4 Describe how to use various types of feeler gauges

4. TASK: Read An Outside Micrometer

PERFORMANCE OBJECTIVE: Given an automotive part with wear, a manufacturer's service manual, and the proper size outside micrometer, measure the size of the part and the wear observed and measured. When completed the measurements will be accurate to .0005 of an inch.

I.C MEASURING INSTRUMENTS

ENABLING OBJECTIVES:

4.1 Explain the importance of accurate measurements when dealing with automotive repairs
4.2 Name the parts of an outside micrometer
4.3 Demonstrate how to calibrate an outside micrometer
4.4 Describe how to read the outside micrometer
4.5 Demonstrate how to measure the size of the part and how to determine the amount of wear present
4.6 Describe how to care for micrometers

5. TASK: Read An Inside Micrometer

PERFORMANCE OBJECTIVE: Given an automotive cylinder and the proper size inside micrometer, measure the automotive cylinder for out of round and tuper wear. When completed, the measurements will be accurate to .0005 of an inch.

ENABLING OBJECTIVES:

5.1 Name the parts of an outside micrometer
5.2 Explain the importance of accurate measurements when dealing with automotive service
5.3 Describe how to care for micrometers
5.4 Demonstrate how to calibrate an inside micrometer
5.5 Describe how to read the inside micrometer
5.6 Demonstrate how to measure the cylinder and to determine the amount of wear present

6. TASK: Read A Dial Indicator

PERFORMANCE OBJECTIVE: Given a dial indicator, necessary mounting accessories, and an automotive component that requires a dial indicator to measure movement, measure the amount of movement. The measurement will be accurate to .0005 of an inch.

ENABLING OBJECTIVES:

6.1 Describe the operation of a dial indicator
6.2 Demonstrate how to mount a dial indicator
6.3 Demonstrate how to "zero" a dial indicator
6.4 Demonstrate how to measure movement using a dial indicator

7. TASK: Identify Vernier Calipers

PERFORMANCE OBJECTIVE: Given a step piece of metal and assortment of vernier calipers, determine the proper tool and measure to 1/64th inch then record the reading.

I.C MEASURING INSTRUMENTS

ENABLING OBJECTIVES:

7.1 Identify Vernier Calipers
7.2 Demonstrate the proper use of Vernier Calipers
7.3 Describe the proper care of Vernier Calipers

8. TASK: Identify Depth Gauges And Their Proper Use

PERFORMANCE OBJECTIVE: Given a piece of metal with a predetermined depth hole in it and assortment of depth gauges, determine the proper depth gauge to use and measure to the nearest .001 inch and record the reading.

ENABLING OBJECTIVES:

8.1 Identify the different types of depth gauges
8.2 Demonstrate the proper use of the depth gauges
8.3 Describe the proper care of the depth gauge

9. TASK: Identify Small Hole Gauges And Their Proper Use

PERFORMANCE OBJECTIVE: Given a piece of metal with a hole drilled through it and assorment of hole gauges, determine the proper hole gauge to use and measure the hold to the nearest .001 inch and record the reading.

ENABLING OBJECTIVES:

9.1 Identify the different types of hole gauges
9.2 Demonstrate the proper use of hole gauges
9.3 Describe the proper care of hole gauges

10. TASK: Identify Telescope Gauges And Their Proper Use

PERFORMANCE OBJECTIVE: Given a piece of metal with 1 1/2" hole or bigger and assortment of telescoping gauges, determine the proper telescoping gauge to use and measure the hole to the nearest .001 inch and record the reading.

ENABLING OBJECTIVES:

10.1 Identify the different types of telescoping gauges
10.2 Demonstrate the proper use of telescope gauges
10.3 Describe the proper care of telescope gauges

11. TASK: Identify Shim Stock In The Proper Measuring Methods

PERFORMANCE OBJECTIVE: Given an appropriate engine and an assortment of shim stock, determine the bearing clearance to the nearest .001 inch and record the reading.

I.C MEASURING INSTRUMENTS

ENABLING OBJECTIVES:

11.1 Identify the different types of shim stock used
11.2 Demonstrate the proper use of shim stock
11.3 Describe the proper care of shim stock

12. TASK: Identify Plastic Gauge And Proper Measuring Methods

PERFORMANCE OBJECTIVE: Given an engine with a bearing complete and plastic gauge, measure the oil clearance and record the reading to the nearest .001 inch.

ENABLING OBJECTIVES:

12.1 Identify the proper plastic gauge to use
12.2 Demonstrate the method and proper use of the plastic gauge
12.3 Describe the proper care of a plastic gauge in storage

13. TASK: Identify Thread Gauges And Their Proper Use

PERFORMANCE OBJECTIVE: Given an assortment of bolts of three and a thread gauge, determine both the size and the thread pitch and threads per inch. Then record the proper readings.

ENABLING OBJECTIVES:

13.1 Identify the proper type thread gauge
13.2 Demonstrate the proper use of the thread gauge to determine the bolt pitch and threads per inch
13.3 Describe the care of the thread gauge

Big Bend Community College
Automotive Mechanics
Competency Modules

I. SHOP SKILLS AND SAFETY

D. Fastening Devices

1. Identify Threaded Fasteners By Size, Hardness, And Thread Pitch

2. Identify Automotive Fastener Locking Devices

3. Identify Various Bolt Head Styles

4. Identify Various Automotive Machine Screw Head Styles

5. Identify Various Automotive Snap Ring Devices

I.D FASTENING DEVICES

1. TASK: Identify Threaded Fasteners By Sizes, Hardness And Thread Pitch

PERFORMANCE OBJECTIVE: Given examples of automotive threaded fasteners, a rule, and a thread pitch gauge, identify their size, hardness and thread pitch using accepted automotive trade terms.

ENABLING OBJECTIVES:

1.1 Describe how bolt diameter is determined in both the U.S. and the metric system
1.2 Describe how bolt length is determined in both the U.S. and the metric system
1.3 Describe the bolt head marking system used by the U.S. and the metric system to determine bolt hardness
1.4 Demonstrate how to use a thread pitch gauge
1.5 Describe which hardness of bolt should be used for various automotive uses

2. TASK: Identify Automotive Fastener Locking Devices

PERFORMANCE OBJECTIVE: Given examples of automotive fastener locking devices describe their use.

ENABLING OBJECTIVES:

2.1 Identify various methods of retaining nuts and bolts
2.2 Describe the effects on turque of the various locking devices
2.3 Identify the best locking device to be used with various operating conditions
2.4 Describe various types of liquid or chemical locking techniques

3. TASK: Identify Various Bolt Head Styles

PERFORMANCE OBJECTIVE: Given examples of automotive threaded fasteners. Identify their head style using accepted automotive trade terms.

ENABLING OBJECTIVES:

3.1 Identify the various shapes of bolt head styles
3.2 Describe the use of each style of bolt head
3.3 Identify the proper tool to be used with each style of fastener

I.D FASTENING DEVICES

4. TASK: Identify Various Automotive Machine Screw Head Styles

PERFORMANCE OBJECTIVE: Given examples of automotive machine screws, identify the head style using accepted automotive trade terms.

ENABLING OBJECTIVES:

4.1 Identify the various shapes of the heads used with automotive machine screws
4.2 Describe the use of each automotive machine screw head style
4.3 Identify the proper tool to be used with each style of fastener

5. TASK: Identify Various Automotive Snap Rings

PERFORMANCE OBJECTIVE: Given examples of various automotive snap and lock ring devices identify them using accepted automotive trade terms.

ENABLING OBJECTIVES:

5.1 Identify various automotive snap and lock rings
5.2 Describe the use of each style of snap ring
5.3 Identify the proper tool to be used with each style of snap ring

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II. ENGINE SERVICE

A. Engine Diagnosing and Testing

1. Perform A Cylinder Compression Test
2. Perform A Cylinder Power Balance Test
3. Perform A Cylinder Leakage Test
4. Perform A Manifold Vacuum Test
5. Perform A Cooling System Pressure Test
6. Perform An Oil Pressure Test
7. Test Engine Under Load

II.A ENGINE DIAGNOSING AND TESTING

1. TASK: Perform A Cylinder Compression Test

PERFORMANCE OBJECTIVE: Provided an engine at normal operating temperatures, tools, gauges and service manual, perform a wet and dry cylinder compression test.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions when testing an operating engine
1.2 Describe steps in preparing an engine for a cylinder compression test
1.3 Describe how to install gauge and take reading
1.4 Explain "wet and dry" test and the reason for each test
1.5 Explain test results

2. TASK: Perform A Cylinder Power Balance Test

PERFORMANCE OBJECTIVE: Provided an engine at normal operating temperatures, and using the correct test equipment and service manual, perform a cylinder balance test. A cylinder-to-cylinder deviation exceeding manufacturer's specification must be detected.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions when operating test equipment on a running engine
2.2 Describe a cylinder power balance test procedure
2.3 Explain reason for RPM variance or drop

3. TASK: Perform A Cylinder Leakage Test

PERFORMANCE OBJECTIVE: Provided an engine at normal operating temperature, tools, equipment and service manual, perform a cylinder leakage test following the manufacturer's recommended procedures. Leakage in excess of manufacturer's specifications must be noted and explained.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions when testing an operating engine
3.2 Describe a cylinder leak test procedure
3.3 Perform and record the results of a cylinder leakage test
3.4 Explain the result of the cylinder leakage test

4. TASK: Perform A Manifold Vacuum Test

PERFORMANCE OBJECTIVE: Provided an engine at normal operating temperatures, tools, equipment and a service manual, perform an engine intake manifold vacuum test.

II.A ENGINE DIAGNOSING AND TESTING

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when testing an operating engine
4.2 Explain the importance and function of intake manifold vacuum
4.3 Identify potential leakage areas of an intake manifold system
4.4 Perform an engine manifold vacuum test
4.5 Explain the results of the engine manifold vacuum test

5. TASK: Perform A Cooling System Pressure Test

PERFORMANCE OBJECTIVE: Given a liquid cooled engine, test the engine cooling system with a pressure tester. Examine engine for internal and external leaks.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when external pressure is applied to cooling systems
5.2 Identify parts of an engine cooling system
5.3 Identify potential sources of internal and external cooling system leaks
5.4 Demonstrate a pressure test on the cooling system and inspect for a pressure loss and visible leaks
5.5 Explain the results of the test

6. TASK: Perform An Oil Pressure Test

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, proper tools and test equipment, test the oil pump pressure.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions when testing an operating engine
6.2 Connect an oil pressure gauge to the proper engine fitting
6.3 Perform an oil pressure check and record results
6.4 Compare readings with manufacturer's recommendations and explain the results

7. TASK: Test Engine Under Load

PERFORMANCE OBJECTIVE: Given an operational vehicle at normal temperature, tools, special testing equipment, and service manuals, test engine under load following manufacturer's procedures.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions
7.2 Explain the purpose of a load test
7.3 Explain the use of a dynometer
7.4 Describe different RPM ranges for tests
7.5 Demonstrate engine performance of different RPM ranges and record deviations from specifications

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Competency Modules

II. ENGINE SERVICE

B. Minor Engine Service

1. Clean The Outside Of An Engine
2. Inspect Engine For Oil Leaks
3. Remove And Replace Core Plugs
4. Remove And Replace Engine Mounts
5. Remove And Replace A Water Pump
6. Remove And Replace A Thermostat
7. Remove And Replace Timing Gears And Chain
8. Remove And Replace Timing Belt
9. Adjust Mechanical Valves
10. Adjust Hydraulic Valves
11. Change Oil And Filter

II.B Minor Engine Service

1. TASK: Clean The Outside Of An Engine

PERFORMANCE OBJECTIVE: Given an automobile with a dirty engine and a pressure washer, clean the outer surface of the engine without causing damage or starting problems.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions when cleaning with high pressure water
1.2 Describe engine parts that can be damaged by water
1.3 Explain drying of distributor and wiring if a problem develops

2. TASK: Inspect Engine For Oil Leaks

PERFORMANCE OBJECTIVE: Given an engine at operating temperature, examine the engine for oil leaks. Note any leaks and explain the proper repair procedure.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Identify and examine the most likely areas on an engine that develop oil leaks
2.3 Distinguish between oil seepage leaks and pressure leakage
2.4 Identify oil leaks that make other areas appear to be leaking
2.5 Describe the function of gaskets, gasket sealers, and oil seals

3. TASK: Remove And Replace Core Plugs

PERFORMANCE OBJECTIVE: Given an engine block and cylinder head, necessary tools and proper equipment, remove and replace core plugs. No leaks should occur.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions
3.2 Explain the function of core plugs
3.3 Demonstrate the method of removal from cylinder head engine block
3.4 Explain the need to clean the water jacket and remove rust from the plug holes
3.5 Demonstrate the replacement of new plugs of the correct size
3.6 Pressure check cooling system and inspect for leaks

4. TASK: Remove And Replace Engine Mounts

PERFORMANCE OBJECTIVE: Given an automobile needing engine mounts, tools, equipment, and service manual, remove and replace engine mounts according to manufacturer's procedures.

II.B Minor Engine Service

ENABLING OBJECTIVES:

4.1 Demonstrate safety procedures
4.2 Explain the function of engine mounts
4.3 Demonstrate the procedure to safely raise the engine and remove a broken motor mount
4.4 Demonstrate the replacement of a new mount

5. TASK: Remove And Replace A Water Pump

PERFORMANCE OBJECTIVE: Given an engine needing a water pump replacement, tools, equipment and service manual, remove and replace the water pump according to manufacturer's procedures. All attachment hardware shall be properly torqued, belt tension properly adjusted and no leaks should be present.

ENABLING OBJECTIVES:

5.1 Demonstrate safety procedures
5.2 Explain the function of the water pump
5.3 Demonstrate how to inspect for proper water pump operation
5.4 Demonstrate the removal of the defective water pump
5.5 Explain the need for complete removal of all old gasket material
5.6 Demonstrate the replacement of the water pump and necessary related parts
5.7 Demonstrate a water pump operational test

6. TASK: Remove And Replace A Thermostat

PERFORMANCE OBJECTIVE: Given an engine needing thermostat replacement, tools, equipment and service manual, remove and replace a thermostat according to manufacturer's procedures. All attachment hardware shall be torqued and the housing must not leak.

ENABLING OBJECTIVES:

6.1 Demonstrate safety procedures
6.2 Explain the function of a thermostat
6.3 Explain how to inspect for proper thermostat operation
6.4 Demonstrate the removal of a thermostat
6.5 Explain the need for complete removal of all the old gasket material
6.6 Explain the need to inspect the thermostat housing
6.7 Demonstrate the installation of a thermostat
6.8 Demonstrate a thermostat operational test

II.B Minor Engine Service

7. TASK: Remove And Replace Timing Gears And Chain

PERFORMANCE OBJECTIVE: Given an automobile engine in need of timing gear and chain replacement, necessary tools, equipment, and service manual, remove and replace harmonic balancer, timing, chain cover, timing gears and chain. Timing must be set according to manufacturer's specifications and cover will not leak. Harmonic balancer must be inspected for wear and slippage.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions
7.2 Explain procedures necessary to prevent valve damage
7.3 Explain the timing marks on balancer, cover, and gears
7.4 Explain the procedure for proper positioning of timing marks
7.5 Demonstrate engine timing in accordance with manufacturer's specifications
7.6 Inspect related parts (harmonic balancer, key, shaft, etc.) for excessive wear and slippage
7.7 Replace all parts
7.8 Demonstrate test procedure for engine oeration and leaks

8. TASK: Remove And Replace Timing Belt

PERFORMANCE OBJECTIVE: Given an automobile with timing belt, tools, equipment, and a manufacturer's service manual, remove and replace the timing belt. Set timing and tension according to manufacturer's specifications.

ENABLING OBJECTIVES:

8.1 Demonstrate safety precautions
8.2 Explain the procedures necessary to prevent valve damage
8.3 Explain the timing marks
8.4 Explain the procedure for setting timing marks before replacing belt
8.5 Demonstrate method of setting belt tension
8.6 Demonstrate test procedure for engine operation

9. TASK: Adjust Mechanical Valves

PERFORMANCE OBJECTIVE: Given an automobile engine with mechanical valve lifters, tools, equipment, and manufacturer's service manual, adjust the exhaust and intake valve "lash" according to manufacturer's specifications. Engine should perform properly without noise or missing, and no oil leaks should be present.

II.B Minor Engine Service

ENABLING OBJECTIVES:

9.1 Demonstrate safety precautions
9.2 Adjust intake and exhaust valve lash using a flat feeler gauge of correct thickness according to manufacturer's specifications
9.3 Explain the necessity for valve lash variation between the intake and exhaust valves
9.4 Explain "noise" made by mechanical valve lifters
9.5 Demonstrate an operational test and inspect for external leakage

10. TASK: Adjust Hydraulic Valves

PERFORMANCE OBJECTIVE: Given an automobile engine with hydraulic lifters, tools, equipment, and a manufacturer's service manual, adjust the intake and exhaust valve lifters according to manufacturer's specifications. The engine should operate with no noise, missing cylinders, or external oil leaks.

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions
10.2 Adjust intake and exhaust valve lifters according to manufacturer's specifications
10.3 Describe the operation of a hydraulic valve lifter and the need for adjustment
10.4 Demonstrate an operational test and inspect for external leakage

11. TASK: Change Oil And Filter

PERFORMANCE OBJECTIVE: Given an automobile, tools, equipment, and a manufacturer's service manual, perform an oil and filter change. The oil level should be correct with no external oil leaks.

ENABLING OBJECTIVES:

11.1 Demonstrate safety precautions
11.2 Demonstrate the procedures necessary to remove and replace the oil filter
11.3 Explain the necessity of lubing the oil filter gasket and inspecting the sealing surface for dirt or old gasket material
11.4 Demonstrate the draining and refilling of the engine crankcase to the proper level
11.5 Perform an operational test and inspect for external leaks

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II. ENGINE SERVICE

C. Major Engine Service

1. Remove And Replace Engine Assembly
2. Disassemble Engine
3. Remove Cylinder Ring Ridge
4. Clean Engine Parts And Visually Inspect Their Condition
5. Precision Measure Engine Components
6. Remove And Replace Pistons, Connecting Rods And Bearings
7. Inspect Block For Warpage
8. Remove And Replace Crankshaft
9. Remove And Replace Cylinder Heads
10. Service Valve Guides
11. Remove And Replace Camshaft Bearings
12. Resurface Valve And Valve Seats And Replace Valve Stem Seals

## II.C MAJOR ENGINE SERVICE

1. TASK: Remove And Replace Engine Assembly

PERFORMANCE OBJECTIVE: Given a vehicle in need of engine removal, tools, hoisting equipment and a manufacturer's service manual, remove and replace the engine according to manufacturer's procedures. No damage will be incurred to accessories, related hardware or equipment.

ENABLING OBJECTIVES:

1.1 Demonstrate all safety precautions and procedures
1.2 Demonstrate the operation of the hoist and other necessary equipment
1.3 Describe protective procedures that can be followed to guard the automobile and accessories in the engine compartment from damage
1.4 Demonstrate removal of engine
1.5 Inspect related accessory components and perform the necessary engine repair and maintenance
1.6 Demonstrate the replacement of the engine
1.7 Demonstrate an operational test and check all related systems and accessories

2. TASK: Disassemble Engine

PERFORMANCE OBJECTIVE: Given an automobile engine to be disassembled for overhaul, tools, equipment and manufacturer's service manual, disassemble the engine in accordance with manufacturer's procedures. Remove all accessories, disassemble the engine, and remove all internal parts without incurring damage.

ENABLING OBJECTIVES:

2.1 Demonstrate safety procedures
2.2 Demonstrate orderly handling of removed parts
2.3 Describe part markings and numbering if not so marked by manufacturer
2.4 Explain "line boring" and how it applies to the rod and main bearing caps
2.5 Demonstrate "ridge" removal prior to piston removal
2.6 Inspect removed parts for excessive wear, breaks,cracks and damage
2.7 Inspect and explain the function of oil galleries
2.8 Inspect and remove core plugs from water jackets
2.9 Inspect and remove cam bearings
2.10 Inspect all main and rod bearing inserts and note stamped size

II.C MAJOR ENGINE SERVICE

3. TASK: Remove Cylinder Ring Ridge

PERFORMANCE OBJECTIVE: Given an automobile engine block needing the ring ridge removed, necessary tools, equipment, and a manufacturer's service manual, remove the cylinder bore upper ring ridge according to the specific ridge reaming tool operation procedure. No excessive ring ridge will remain in the cylinder. Any cracks or excessive wear will be noted.

ENABLING OBJECTIVES:

3.1 Demonstrate safety procedures
3.2 Explain reason for the removal of the ring ridge
3.3 Explain what may happen to new piston and rings if it is not removed
3.4 Demonstrate the removal of the ridge from the cylinders

4. TASK: Clean Engine Parts And Visually Inspect Their Condition

PERFORMANCE OBJECTIVE: Given a disassembled engine, with access to proper cleaning equipment, tools and a manufacturer's service manual, clean all engine parts. Identify all parts needing maintenance, repair or replacement. Cracked, broken or parts worn beyond manufacturer's specifications must be replaced. Engine parts must be protected from damage and dirt until ready for reassembly.

ENABLING OBJECTIVES:

4.1 Demonstrate safety procedures
4.2 Explain proper handling of matched parts
4.3 Describe the cleaning procedures of machine surfaces, threaded holes, and oil galleries
4.4 Demonstrate the use of a hot tank to clean the block, heads and associated engine parts
4.5 Explain why aluminum must not be cleaned in a hot tank
4.6 Demonstrate how to protect and store engine parts awaiting engine assembly

5. TASK: Precision Measure Engine Components

PERFORMANCE OBJECTIVE: Given a disassembled and cleaned engine, necessary tools, equipment and a manufacturer's service manual, measure all engine parts for wear. Any part exceeding manufacturer's wear specifications must be repaired or replaced before the engine can be reassembled.

II.C MAJOR ENGINE SERVICE

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions
5.2 Explain the operation of a micrometer
5.3 Demonstrate the use of an inside and outside micrometer noting any diviation from manufacturer's specifications for wear
5.4 Inspect all parts subject to wear
5.5 Identify parts found not to meet specifications

6. TASK: Remove And Replace Pistons, Connecting Rods And Bearings

PERFORMANCE OBJECTIVE: Given an engine, tools, equipment and a manufacturer's service manual, remove and replace pistons, rods, and bearings according to manufacturer's specifications.

ENABLING OBJECTIVES:

6.1 Demonstrate safety procedures
6.2 Demonstrate procedures for protecting crankshaft when removing and installing pistons and connecting rod assemblies
6.3 Demonstrate the use of cylinder deglazer
6.4 Explain the reason for lubricating all parts prior to installation
6.5 Demonstrate measuring ring side clearance and ring end gap to ensure they meet manufacturer's specifications
6.6 Demonstrate use of a ring compressor
6.7 Demonstrate torqueing of the rod cap bolts

7. TASK: Inspect Block For Warpage

PERFORMANCE OBJECTIVE: Given an automobile engine block, with necessary tools, equipment and a manufacturer's service manual, inspect the blocks machined surfaces for warpage. Any warpage in excess of manufacturer's specifications must be corrected by proper maching at an automotive machine shop. There should not be any cracks or defects in the finished block.

ENABLING OBJECTIVES:

7.1 Demonstrate safety procedures
7.2 Explain the procedure for surface inspection
7.3 Explain the need for appropriate machining
7.4 Inspect all engine block surfaces, making sure it meets manufacturer's specifications

II.C MAJOR ENGINE SERVICE

8. TASK: Remove And Replace Crankshaft

PERFORMANCE OBJECTIVE: Given an engine block prepared for assembly, necessary tools, equipment, and a manufacturer's service manual, replace the main bearings, oil seals and crankshaft according to the manufacturer's suggested procedure. All main bearing caps will be installed as numbered in indicated position, properly torqued, and the bearing clearance measured with plastigage to ensure it meets the manufacturer's specifications.

ENABLING OBJECTIVES:

8.1 Demonstrate safety procedures
8.2 Describe the procedure to measure bearing clearance using the "plastigage" material
8.3 Explain the necessity of bearing clearance
8.4 Describe torque procedure for main bearings
8.5 Demonstrate bearing fitting and proper main bearing positioning with oil seals in place
8.6 Demonstrate the procedure to measure crankshaft end play

9. TASK: Remove And Replace Cylinder Heads

PERFORMANCE OBJECTIVE: Given a vehicle with cylinder head malfunctions, tools, equipment, and a manufacturer's service manual, remove and replace cylinder head in accordance with the manufacturer's suggested procedure. All attaching hardware must be torqued and head gasket and manifolds must not leak.

ENABLING OBJECTIVES:

9.1 Demonstrate safety procedures
9.2 Demonstrate removal of the cylinder head and related components
9.3 Clean all cylinder head and intake manifold machined surfaces
9.4 Explain why valves and all related parts must be kept in order
9.5 Magnaflux or dye test cylinder head for cracks
9.6 Inspect cylinder head for warpage
9.7 Clean the cylinder block machined surfaces
9.8 Demonstrate installation of head gasket, cylinder head, intake and exhaust manifold
9.9 Demonstrate tightening sequence of cylinder head and manifold bolts
9.10 Demonstrate an operational test of engine

10. TASK: Service Valve Guides

PERFORMANCE OBJECTIVE: Given a disassembled cylinder head, tools, equipment, and a manufacturer's service manual, inspect the valve guides for wear according to the manufacturer's specifications.

II.C MAJOR ENGINE SERVICE

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions
10.2 Explain the importance of proper valve guide to valve stem clearance
10.3 Demonstrate measuring valve guid wear and determine if the valve guides require repair or replacement according to the manufacturer's specifications
10.4 Describe several methods of correcting excessive valve guide wear
10.5 Demonstrate the repair or replacement of worn valve guides

11. TASK: Remove And Replace Camshaft Bearings

PERFORMANCE OBJECTIVE: Given an automobile engine needing camshaft bearings, tools, equipment, and a manufacturer's service manual, remove and replace camshaft bearings according to manufacturer's specifications.

ENABLING OBJECTIVES:

11.1 Demonstrate safety precautions
11.2 Explain camshaft function and the need for proper bearing fit and placement
11.3 Demonstrate replacement of camshaft bearings using cure in placement of oil holes
11.4 Replace camshaft, gears and timing chain and related parts
11.5 Demonstrate operational test and inspect for external leakage

12. TASK: Resurface Valve And Valve Seats And Replace Valve Stem Seals

PERFORMANCE OBJECTIVE: Given a cylinder head needing a valve grind and necessary tools, equipment, and a manufacturer's service manual, perform a valve job in accordance with manufacturer's specifications. All seals must be replaced when the valve is properly installed. Resurfaced valves will perform without leaks, binds or noise.

ENABLING OBJECTIVES:

12.1 Demonstrate safety precautions
12.2 Explain the reason for valve seals
12.3 Inspect all valves for wear and burning
12.4 Demonstrate valve refacing following the procedure recommended for the valve face resurfacer furnished
12.5 Inspect valve seats for wear and burning
12.6 Explain the importance of valve seat width
12.7 Explain the importance of valve and valve seat mating
12.8 Measure valve guides to determine if repair or replacement is necessary
12.9 Repair valve guides as necessary
12.10 Demonstrate valve seat resurfacing

II.C MAJOR ENGINE SERVICE

12.11 Demonstrate valve seat narrowing and adjusting seat and face contract
12.12 Demonstrate valve spring inspection
12.13 Explain valve spring install height
12.14 Explain valve stem height
12.15 Demonstrate valve installation following manufacturer's specifications

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III. BRAKES, SUSPENSION AND STEERING

A. Brake Service

1. Perform Operational Brake Test
2. Perform A Visual Inspection Of All System Components
3. Flush Brake System
4. Replace Brake Hoses, Control Valves, Lines And Fittings
5. Adjust Brake Shoes, Self And Non-self Adjusting Type
6. Remove And Replace Brake Shoes
7. Recondition Or Replace Wheel Cylinder
8. Machine Brake Drums
9. Service/Replace/And/Or Adjust Parking Brake Linkage Cables
10. Adjust Parking Brake (External Band)
11. Service And/or Replace Disc Brake Pads
12. Machine Disc Brake Rotors
13. Remove And Replace Disc Brake Caliper Assembly And Rotor
14. Rebuild Disc Brakes Caliper Assembly
15. Remove, Rebuild And Replace Master Cylinder
16. Test, Remove And Replace Hydraulic Brake Vacuum Power Units
17. Remove And Replace The Proportioning Valve, The Pressure Differential Valve Or The Combination Valve
18. Bleed Brake System
19. Test Brake Anti-Lock System
20. Remove And Replace Anti-Lock System Components

III.A BRAKE SERVICE

1. TASK: Perform Operational Brake Test

PERFORMANCE OBJECTIVE: Given a vehicle needing an operational brake test, proper service manual, and access to necessary tools and equipment, perform an operational brake test. Record malfunctions for the following:

1. Brake warning light operation
2. Brake pedal reserve
3. Brake pedal action
4. Vehicle's braking behavior
5. Braking noises

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions while testing a vehicle with possible brake problems
1.2 Define pedal reserve
1.3 Describe vehicle braking behavior
1.4 Demonstrate vehicle braking action during an emergency stop

2. TASK: Perform A Visual Inspection Of All System Components

PERFORMANCE OBJECTIVE: Given a vehicle needing a visual brake inspection, proper service manual, and access to necessary tools and equipment, perform a visual inspection of all system components. Record findings for the following items:

1. Master cylinder reservoir fluid level
2. Leaks
3. Brake hose condition
4. Brake lining condition and thickness
5. Brake drum diameter, and condition
6. Brake rotor thickness, runout and parallelism
7. Brake pad thickness

ENABLING OBJECTIVES:

2.1 Demonstrate safety procedures while removing wheels, etc. for inspection
2.2 Demonstrate how to read micrometers (brake drum type)
2.3 Identify specifications for vehicle in question in proper shop manual
2.4 Define rotor runout and parallelism
2.5 Inspect all brake lines and flexible hoses
2.6 Demonstrate removal of wheels, etc. for visual lining inspection

III.A BRAKE SERVICE

3. TASK: Flush Brake System

PERFORMANCE OBJECTIVE: Given a vehicle with contaminated brake fluid and access to necessary tools and ample brake fluid, flush the brake system at each wheel until no air or contamination exist in the fluid.

ENABLING OBJECTIVES:

3.1 Demonstrate safety procedures while working with a brake hydraulic system
3.2 Describe proper jacking and supporting vehicle
3.3 Discuss handling of fluid (keeping out of eye and off any painted surface)
3.4 Explain brake fluid grades or types
3.5 Demonstrate brake flushing at each wheel

4. TASK: Replace Brake Hoses, Control Valves, Lines And Fittings

PERFORMANCE OBJECTIVE: Given a vehicle needing brake hoses, control valves, lines and fittings, proper service manual, and access to necessary tools and equipment, replace brake hoses, control valves, lines and fittings. Brake hoses are to be properly mounted, secured and routed; control valves are to be properly mounted and secured; lines are to be properly mounted, secured, and routed; and there will be no leaks at any connection.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when working on a brake hydraulic system
4.2 Explain control valve functions
4.3 Demonstrate proper use of brake line wrenches
4.4 Inspect system for proper routing, leaks, and mounting
4.5 Demonstrate proper bleeding of air from hydraulic system
4.6 Explain why air must be removed from the system

5. TASK: Adjust Brake Shoes, Non-self Adjusting Type

PERFORMANCE OBJECTIVE: Given a vehicle with non-self adjusting brakes, proper service manual, and access to necessary tools and equipment, adjust the brakes. Each wheel must be free of drag and the vehicle will not pull to either side when brakes are applied. Check tire type, tire size, tread condition and air pressure to avoid erratic brake action.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when working with a brake system
5.2 Explain correct direction to move adjustor
5.3 Demonstrate properly adjusted drum brake system
5.4 Explain importance of type, size and air pressure of tires on vehicle

III.A BRAKE SERVICE

6. TASK: Remove And Replace Brake Shoes (Self Adjusting)

PERFORMANCE OBJECTIVE: Given a vehicle with worn brake shoes, service manual, and access to necessary tools and equipment, replace brake shoes. Worn shoes will be removed, backing plate platforms will be serviced, replacement shoes and shoe return springs will be positioned correctly, and self-adjusting mechanisms will be correctly positioned and serviced. Front wheel bearings must be lubricated and adjusted to torque specifications.

ENABLING OBJECTIVES:

6.1 Demonstrate the use of special brake tools
6.2 Demonstrate safety precautions on the work being done and while working on a brake system
6.3 Explain need to rebuild wheel and master cylinder
6.4 Explain how self-adjuster works
6.5 Demonstrate operation of brakes immediately after brake shoes are replaced
6.6 Demonstrate precautions necessary in driving the vehicle immediately after brake shoe replacement
6.7 Demonstrate handling of wheels and hubcaps during the brake repair job

7. TASK: Repair Or Replace Wheel Cylinder

PERFORMANCE OBJECTIVE: Given a vehicle with a defective wheel cylinder, proper service manual, and access to necessary tools and equipment, repair or replace wheel cylinder. Standard brake system will operate properly with firm pedal and no fluid leaks.

ENABLING OBJECTIVES:

7.1 Explain the methods used to determine cylinder condition
7.2 Describe the safety procedures used to repair a cylinder
7.3 Explain how new parts were installed into cylinder
7.4 Demonstrate the use of the following special tools:
    7.4.1 Brake cylinder hone
    7.4.2 Brake bleeding tools
7.5 Inspect for leaks
7.6 Demonstrate proper brake operation after repair
7.7 Explain safety precautions

8. TASK: Machine brake drums

PERFORMANCE OBJECTIVE: Given a set of brake drums neecing machining, service manual, and access to necessary tools, equipment, and materials, machine drums. The drums will be machined to a tolerance allowed by the manufacturer's specifications and D.O.T. regulations, and the surface will be smooth across the width.

III.A BRAKE SERVICE

ENABLING OBJECTIVES:

8.1 Demonstrate safety precautions when using a brake drum lathe
8.2 Demonstrate the proper use of a brake drum lathe
8.3 Demonstrate the use of a brake drum micrometer
8.4 Explain when proper cut on brake drum surface has been made

9. TASK: Service/replace and/or adjust parking brake linkage and cables

PERFORMANCE OBJECTIVE: Given a vehicle needing brake attention, proper service manual, and access to necessary tools and equipment, replace and adjust parking linkage. The linkage must be properly routed, secured and positioned, the vehicle will not roll with parking brake applied.

ENABLING OBJECTIVES:

9.1 Demonstrate safety precautions
9.2 Explain how parking brakes operate
9.3 Explain how to free-up binding cables
9.4 Demonstrate park brake cable adjustment

10. TASK: Adjust Parking Brake (External Band)

PERFORMANCE OBJECTIVE: Given a vehicle with external band parking brake, proper service manual, and access to necessary tools and equipment, adjust parking brake. The vehicle will not roll with parking brake applied. Proper clearance will be set between band and drum with the brake disengaged.

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions
10.2 Determine places at which measurements are to be taken
10.3 Demonstrate adjustment of external band

11. TASK: Service And/or Replace Disc Brake Pads

PERFORMANCE OBJECTIVE: Given a vehicle with worn disc brake pads, proper service manual, and access to necessary tools and equipment, service and/or replace pads. Worn pads will be removed, caliper support will be properly serviced, the pads will be properly located, and the anti-rattle springs will be properly positioned.

ENABLING OBJECTIVES:

11.1 Demonstrate safety precautions while working around a raised and supported vehicle
11.2 Explain proper service needs for the specific vehicle
11.3 Demonstrate the proper lubricating of wheel bearings, seal inspection and bearing adjustment while caliper is off for pad replacement

11.4 Demonstrate brake pad removal and safe placement of caliper
11.5 Inspect and measure wear of rotor with a micrometer
11.6 Demonstrate replacement of pads and caliper

12. Machine Disc Brake Rotors

PERFORMANCE OBJECTIVE: Given a set of brake rotors needing machining, proper service manual, and access to tools, equipment, and materials, machine rotors. Machine rotors to the tolerance allowed by the manufacturer, with surfaces parallel, no runout, and a non-directional, smooth surface finish.

ENABLING OBJECTIVES:

12.1 Demonstrate safety procedures when using a disc brake lathe
12.2 Demonstrate the proper use of a disc brake lathe
12.3 Describe the use of a special micrometer for measuring rotors

13. TASK: Remove And Replace Disc Brake Caliper Assembly And Rotor

PERFORMANCE OBJECTIVE: Given a vehicle with disc brakes, necessary tools and equipment, remove and replace the caliper and rotor according to manufacturer's procedure.

ENABLING OBJECTIVES:

13.1 Demonstrate safety precautions
13.2 Demonstrate use of special tools
13.3 Inspect rotor for wear and/or warpage (damage)
13.4 Inspect caliper for corrosion and leakage
13.5 Inspect brake pads for wear
13.6 Demonstrate removal and repair of caliper and rotor
13.7 Explain proper position of caliper piston after pad replacement

14. TASK: Rebuild Disc Brakes Caliper Assembly

PERFORMANCE OBJECTIVE: Given a vehicle with a defective disc brake caliper, proper service manual, and access to necessary tools and equipment, repair disc brakes caliper. The caliper bore will be properly serviced; the piston seal, piston and dust seal properly installed, and the machined surfaces of caliper properly serviced.

ENABLING OBJECTIVES:

14.1 Demonstrate safety precautions when working on a hydraulic brake system
14.2 Demonstrate use of special caliper tools
14.3 Demonstrate use of bore or cylinder hone
14.4 Explain caution and careful inspection necessary in rebuilding a caliper cylinder
14.5 Demonstrate proper procedure in rebuilding caliper cylinder
14.6 Explain need for the cylinder dust boot

III.A BRAKE SERVICE

15. TASK: Remove, Rebuild And Replace Master Cylinder

PERFORMANCE OBJECTIVE: Given a vehicle with a defective master cylinder, proper service manual, and necessary tools, remove, rebuild then replace master cylinder. Master cylinder must be rebuilt and installed according to manufacturer's procedures. All attaching hardware must be torqued to specifications, pedal must be firm and line connections must not leak.

ENABLING OBJECTIVES:

15.1 Demonstrate safety precautions when working with a hydraulic brake system
15.2 Explain the method used to determine master cylinder condition
15.3 Demonstrate the use of special tools
15.4 Describe the need to hone the cylinder
15.5 Describe cleaning all parts and valves
15.6 Explain how new parts are installed, function of lock screw (if used) and snap rings
15.7 Explain the differences in master cylinders

16. TASK: Test, Remove, And Replace Hydraulic Brake Vacuum Power Units

PERFORMANCE OBJECTIVE: Given a vehicle with a defective brake power unit, proper service manual, and access to necessary tools and equipment, test and replace hydraulic brake power unit. Demonstrate that all vacuum connections are properly routed and connected and that brake pedal behavior reflects proper operation, with no vacuum or fluid leaks.

ENABLING OBJECTIVES:

16.1 Demonstrate safety precautions
16.2 Describe vacuum effect on unit
16.3 Demonstrate operation of power brake unit

17. TASK: Remove And Replace The Proportioning Valve, The Pressure Differential Valve Or The Combination Valve

PERFORMANCE OBJECTIVE: Given a vehicle needing a control valve replacement (proportioning valve, metering valve, pressure differential valve, or combination valve), service manual with access to necessary tools and equipment, replace the valve and/or lines or fittings as necessary. Valve unit must not leak fluid and all air must be removed from the system by bleeding the front and rear systems at the nearest bleeder screw.

III.A BRAKE SERVICE

ENABLING OBJECTIVES:

17.1 Demonstrate safety precautions when working on a hydraulic brake system
17.2 Explain the function of valve being installed
17.3 Describe the need to blled the system
17.4 Explain the function of the brake light
17.5 Demonstrate resetting brake warning light switch

18. TASK: Bleed Brake System

PERFORMANCE OBJECTIVE: Given a vehicle needing the brakes bled, proper service manual, and access to necessary tools and equipment, bleed the brakes within twice the time allowed by the flat rate manual. All air from line will be removed and the pedal will be firm.

ENABLING OBJECTIVES:

18.1 Demonstrate safety precautions when working with hydraulic brake fluid
18.2 Demonstrate proper use of bleeder tools and equipment
18.3 Explain brake pedal action when all air has been removed from the system
18.4 Describe bleeding procedure for removal of air from brake system

19. TASK: Test Brake Anti-Lock System

PERFORMANCE OBJECTIVE: Given a vehicle needing the anti-lock system tested, road check the vehicle to determine the problem. No wheel will lock (skid) when brakes are firmly applied or otherwise deviate from manufacturer's specifications.

ENABLING OBJECTIVES:

19.1 Demonstrate safety precautions when road checking a vehicle with known brake defect
19.2 Identify which wheel has problems or other system defects
19.3 Explain the need for proper road check driving procedures
19.4 Describe any problems with the braking system

20. TASK: Remove And Replace Anti-Lock System Components

PERFORMANCE OBJECTIVE: Given a vehicle with a defective anti-lock system, proper service manual, and access to necessary tools and equipment, repair or replace the component. Components must be installed according to manufacturer's recommendation. All wheels must function properly under firm pedal pressure without lock-up (skid).

III.A BRAKE SERVICE

ENABLING OBJECTIVES:

20.1 Demonstrate safety precautions when working on a brake system
20.2 Identify the component location and function
20.3 Explain the function of anti-lock system
20.4 Demonstrate proper function of anti-lock brake system

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III. BRAKES, SUSPENSION AND STEERING

B. Suspension

1. Inspect Suspension System Components
2. Remove And Replace Suspension Bushings
3. Inspect Tire And Wheel Assembly
4. Rotate Tires
5. Balance Wheel And Tire Assembly
6. Inspect And Service Wheel Bearing And Seal
7. Remove And Replace Shock Absorbers
8. Remove And Replace Control Arms
9. Remove And Replace Ball Joints
10. Remove And Replace Torsion Bar(s)
11. Remove And Replace Coil Springs
12. Remove And Replace King Pin And Bushings
13. Remove And Replace Steering Spindle (Ball Joints)
14. Remove And Replace McPherson Strut Assembly
15. Rebuild McPherson Strut
16. Remove And Replace Leaf Springs
17. Lubricate Chassis
18. Inspect Twin I Beam And Repair As Needed

III.B SUSPENSION

1. TASK: Inspect Suspension System Components

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, inspect the suspension system components. All parts worn beyond manufacturer's specifications must be detected.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions
1.2 Identify the different types of suspension systems
1.3 Demonstrate the proper procedure in order to inspect the suspension system
1.4 Describe shock absorber function
1.5 Identify steering linkage parts
1.6 Identify defective front and rear suspension assemblies

2. TASK: Remove And Replace Suspension Bushings

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools remove and replace the suspension bushings, correct bushing positioning will be accomplished and there will be no evidence of "bushing windup".

ENABLING OBJECTIVES:

2.1 Demonstrate safety procedures for removal of suspension parts
2.2 Describe systems of bushings in need of replacement
2.3 Demonstrate safety precautions while working with coil springs
2.4 Demonstrate control of coil spring and removal of suspension parts needing bushing
2.5 Demonstrate R & R of bushings in suspension bushing to avoid "windup".

3. TASK: Inspect Tire And Wheel Assembly

PERFORMANCE OBJECTIVE: Given a tire and wheel assembly and proper tools inspect it for serviceability. When completed, the following items should have been checked. Air pressure, irregular wear, physical damage (cuts, etc.) and radial and lateral run-out.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions
3.2 Describe different wear patterns for different trend design
3.3 Discuss the advantages and disadvantages of bias versus radial tires
3.4 Describe different wheel rim widths and tire sizes
3.5 Identify tire wear indicator bars
3.6 Define radial and lateral run-out cupping, dish, feather edge, and alignment

III.B SUSPENSION

4. TASK: Rotate Tires

PERFORMANCE OBJECTIVE: Given a vehicle, service manual and proper tools, rotate the tires. When finished, the lug nuts will be torqued to specifications and tires will be positioned considering the type of tires on the vehicle.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when vehicle is raised and wheels removed
4.2 Demonstrate how to properly raise a vehicle to rotate the tires
4.3 Demonstrate proper handling of tire and hubcaps, and lug nuts while removed from the vehicle
4.4 Explain need to check tire and wheel balance at this time
4.5 Demonstrate proper rotation of tires (bias ply or radial ply)

5. TASK: Balance Wheel And Tire Assembly

PERFORMANCE OBJECTIVE: Given a wheel and tire assembly, wheel balancer, and proper tools and wheel weights, balance the assembly.

ENABLING OBJECTIVES:

5.1 Demonstrate safety procedures
5.2 Define the terms "static" and "dynamic" balancing
5.3 Demonstrate locating position for wheel weights according to the type of balance
5.4 Explain why a certain size weight was used
5.5 Explain varying methods of attaching wheel weights based on wheel construction
5.6 Demonstrate balancer available

6. TASK: Inspect And Service Wheel Bearing And Seal

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, grease, seal, inspect and service the wheel bearing and seal.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions while removing a wheel from a raised vehicle
6.2 Explain what will happen if the wheel bearing is over tightened or under tightened
6.3 Demonstrate proper removal, cleaning and grease packing of wheel bearings
6.4 Demonstrate replacement of bearings and seal
6.5 Demonstrate bearing adjustment and spindle nut locking procedure
6.6 Demonstrate proper replacement of dust cap

III.B SUSPENSION

7. TASK: Remove And Replace Shock Absorbers

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and tools, remove and replace shock absorbers. When finished shock bolts will be correctly tightened and proper shock selection will be appropriate.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions when working under a raised vehicle
7.2 Explain the difference between a standard, heavy duty, or special purpose type of shock absorber
7.3 Describe two purposes of shock absorbers
7.4 Demonstrate torque of shock absorber rubber grommets
7.5 Demonstrate test for operation and noise of shock absorbers

8. TASK: Remove And Replace Control Arms

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools remove and replace control arms. When finished, the control arm bolts must be tightened according to specifications and all retaining devices installed.

ENABLING OBJECTIVES:

8.1 Demonstrate safety precautions when removing major suspension components
8.2 Describe several dangerous aspects of removing and replacing a control arm
8.3 Explain why the front end must be aligned after installing new control arms
8.4 Demonstrate ability to control coil spring while removing and replacing control arms
8.5 Demonstrate replacement of control arm with correct positioning of bushings to avoid "bushing wind-up"

9. TASK: Remove And Replace Ball Joints

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace the ball joints. The ball joint bolts should be checked for proper torque, the amount of grease, and cotter pin installation.

ENABLING OBJECTIVES:

9.1 Demonstrate safety procedures while working on a raised vehicle
9.2 Explain the difference between upper and lower load bearing ball joints
9.3 Demonstrate use of necessary special tools and cutting tools
9.4 Define "load bearing" as applied to ball joints
9.5 Determine acceptable "ball joint wear limits"
9.6 Demonstrate replacement of new ball joint, proper torque and locking procedure of all holding nuts and bolts

III.B SUSPENSION

10. TASK: Remove And Replace Torsion Bar(s)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools remove and replace the torsion bar(s). When completed, proper bolt torque will be checked as well as equal curb height being adjusted.

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions when working under a raised vehicle
10.2 Explain how the curb height can be adjusted on most torsion bar equipped vehicles
10.3 Demonstrate removal and replacement of torsion bar and curb height adjustment procedure

11. TASK: Remove And Replace Coil Spring(s)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and required tools, remove and replace the coil spring(s). When completed the springs must be properly seated.

ENABLING OBJECTIVES:

11.1 Demonstrate safety procedures when working under a raised vehicle
11.2 Demonstrate the use of a spring compressor
11.3 Describe special tools needed to release ball joint connection
11.4 Demonstrate replacing and seating of replacement coil spring

12. TASK: Remove And Replace King Pins And Bushings

PERFORMANCE OBJECTIVE: Given a vehicle, service manual and necessary tools, remove and replace king pins and bushings. When completed all bolts should be tight, cotter pins installed, new bushings aligned and reamed for proper fit, and the assembly greased.

ENABLING OBJECTIVES:

12.1 Demonstrate safety precautions when working on a raised vehicle
12.2 Explain how a bushing is fitted and align reamed
12.3 Identify king pins to be removed
12.4 Demonstrate king pin removal
12.5 Demonstrate fitting of king pin and bushing
12.6 Demonstrate toe-in adjustment of front wheels

13. TASK: Remove And Replace Steering Spindle (Ball Joint Type)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and proper tools, remove and replace the steering spindle. When completed, all attaching bolts and cotter pins must be checked for security.

III.B SUSPENSION

ENABLING OBJECTIVES:

13.1 Demonstrate safety precautions when working on a raised vehicle
13.2 Discuss the importance of not straightening or heating a bent steering spindle
13.3 Describe special tools needed to remove a spindle held by ball joints
13.4 Demonstrate removal of spindle
13.5 Inspect all related parts, (hub, bearings, backing plate, brake parts, etc.)
13.6 Demonstrate replacement of all related parts

14. TASK: Remove And Replace McPherson Strut Assembly

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and proper tools, remove and replace the McPherson strut assembly. All attachment hardware must be torqued to specifications, ride height must be correct, and wheels must turn to their extremes without binding.

ENABLING OBJECTIVES:

14.1 Demonstrate safety precautions when working on a raised vehicle
14.2 Identify several cars that are McPherson strut equipped and discuss the differences of such cars
14.3 Explain special tools used for safe operation
14.4 Identify a McPherson strut assembly and explain its construction
14.5 Demonstrate removal of strut assembly and control of the coil spring
14.6 Demonstrate replacement of strut assembly and all related parts

15. TASK: Rebuild McPherson Strut

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and proper tools, rebuild a McPherson strut. Upon completion, the strut must not bind, there should be no leaks and all snap rings and rubber boots should be secured.

ENABLING OBJECTIVES:

15.1 Demonstrate safety precautions
15.2 Explain the advantages and/or disadvantages of a McPherson strut as compared to other front end designs
15.3 Inspect unit to be disassembled for external damage
15.4 Demonstrate disassembly of strut and inspection of internal parts
15.5 Demonstrate assembly, installation and testing for operation of strut assembly

16. TASK: Remove And Replace Leaf Springs

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and proper tools, remove and replace leaf springs. When completed, the springs should allow for the correct curb height, all nuts and u-bolts secure.

III.B SUSPENSION

ENABLING OBJECTIVES:

16.1 Demonstrate safety precautions when working on a raised vehicle
16.2 Compare the operation of leaf springs, coil springs, and torsion bar action
16.3 Identify the components of the spring assembly and describe their functions
16.4 Demonstrate removal of leaf type spring
16.5 Demonstrate replacement, bolt torue, and check of curb height

17. TASK: Lubricate Chassis

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and proper tools, lubricate suspension points.

ENABLING OBJECTIVES:

17.1 Demonstrate safety precautions while raising a vehicle on a hoist
17.2 Describe "greased" joints versus "nongreaseable" joints
17.3 Inspect and clean all fittings to be lubricated
17.4 Explain use of a lubricating chart for a specific vehicle
17.5 Demonstrate the lubricating equipment

18. TASK: Inspect Twin I Beam Suspension

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and tools, inspect Twin I beam suspension. Any worn parts should be identified.

ENABLING OBJECTIVES:

18.1 Demonstrate safety precautions when working under a raised vehicle
18.2 Define Twin I beam suspension
18.3 Describe points to be checked during inspection

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III. BRAKES, SUSPENSION AND STEERING

C. Steering Systems

1. Inspect Steering Gear And Linkage
2. Service Power Steering Fluid Level
3. Lubricate Manual Steering Gear Box
4. Adjust Steering Sector (Manual And Power)
5. Remove And Replace Steering Components
6. Remove And Replace Hydraulic Components In Power Steering Systems
7. Remove And Replace Power Steering Belt(s)
8. Remove And Replace Power Steering Seals And Boots
9. Rebuild Rack And Pinion Manual Assembly
10. Align Front End
11. Align Rear End
12. Remove And Replace Steering Wheel

III.C STEERING SYSTEMS

1. TASK: Inspect Steering Gear And Linkage

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, inspect the steering gear and linkage. Any parts that are worn beyond limits will be listed.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions when working under a raised vehicle
1.2 Explain the importance safety wise of inspecting the steering gear and linkage
1.3 Demonstrate methods of testing parts for excessively worn limits
1.4 Identify steering parts to be inspected for wear
1.5 Describe an excessive worn part

2. TASK: Service Power Steering Fluid Level

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, service power steering fluid level. All fluid levels less than operating level must be detected and filled to proper level.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Describe the difference between several types of fluids on the market that couldb e used in the steering system
2.3 Identify power steering major parts
2.4 Describe method used to determine fluid level and fill to proper level
2.5 Inspect for power steering fluid leaks and any loose steering parts

3. TASK: Lubricate Manual Steering Gear Box

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, lubricate manual steering gear box. Proper level will be checked.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions
3.2 Explain why different gear boxes operate most effectively with varying weights of greases and/or oils
3.3 Explain how grease or oil level may be determined
3.4 Demonstrate proper gear box lubricating method
3.5 Inspect gear box for safe operation

III.C STEERING SYSTEMS

4. TASK: Adjust Steering Sector (Manual And Power)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, adjust steering sector. Steering sector play must be within specifications and have no rough steering when going from extreme left to extreme right turning. The adjustment screw lock nut must be secure when the task is completed.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when working on steering parts
4.2 Describe the major difference in adjusting a manual steering sector versus a power steering sector
4.3 Demonstrate adjustment of steering sector
4.4 Demonstrate operational test after adjustment
4.5 Inspect for excessively worn parts

5. TASK: Remove And Replace Steering Components

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace steering linkage components. Items to be included are:

1. Tie rod
2. Center link (Drag link)
3. Pitman arm
4. Idler arm
5. Steering knuckle
6. Steering sector
7. Damper

When completed, all components' attaching nuts are to be checked for torque. All locking devices must be installed correctly.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when working on steering components
5.2 Demonstrate how to use a tie rod separator
5.3 Demonstrate removal and replacement of steering parts
5.4 Inspect all steering parts for proper security (lock nuts and cotter pins)
5.5 Identify and define junction of all steering components

III.C STEERING SYSTEMS

6. TASK: Remove And Replace Hydraulic Components In Power Steering Systems

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace hydraulic components in power steering system. Items to be included are:

1. Hose(s) and line(s)
2. Steering cylinder
3. Control valve
4. Pump

When completed there should be no leaks, all attaching bolts secured and all lines and hoses routed properly where applicable.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions for working on hydraulic power steering components
6.2 Explain pressure of these systems
6.3 Identify all power steering units and explain functions
6.4 Demonstrate removal and replacement of components selected for removal
6.5 Inspect for leakage, loose, worn or damaged parts

7. TASK: Remove And Replace Power Steering Belt(s)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace steering belt(s). Upon completion, belt tension must be correct, properly aligned and adjusting bolts secured.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions when working on steering components
7.2 Describe how belts are sized according to length, design and width
7.3 Identify belt to be removed and bolts used to release belt tension
7.4 Demonstrate removal and replacement of selected belt
7.5 Demonstrate proper gauge tension on replaced belt (or hand method)
7.6 Demonstrate operational test

8. TASK: Remove And Replace Power Steering Seals And Boots

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace power steering seals and boots. Upon completion, the unit must not leak or be damaged.

III.C STEERING SYSTEMS

ENABLING OBJECTIVES:

8.1 Demonstrate safety procedure while working on the power steering hydraulic system
8.2 Describe three different type seals used in power steering
8.3 Identify major parts of power steering units
8.4 Demonstrate removal and replacement of power steering components and seals
8.5 Inspect for leaks and proper operation

9. TASK: Rebuild Rack And Pinion Manual Assembly

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, rebuild rack and pinion steering assembly. The unit must turn smoothly, have proper free play and not leak. All bolts will be torqued according to specifications.

ENABLING OBJECTIVES:

9.1 Demonstrate safety precautions while working on steering systems
9.2 Explain the operation of a rack and pinion assembly as compared to a conventional steering box
9.3 Identify components of the rack and pinion assembly
9.4 Demonstrate removal and disassembly of the rack and pinion component
9.5 Inspect for worn and damaged parts
9.6 Demonstrate assembly and replacement of unit on vehicle
9.7 Demonstrate operational test

10. TASK: Align Front End

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools and equipment, align front end. The toe, caster, and camber should meet manufacturer's specifications.

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions while working under a vehicle
10.2 Define toe-in, caster and camber
10.3 Identify adjustment points of the front end for toe-in, caster, and camber setting
10.4 Describe tools and equipment necessary to align automobile front end
10.5 Demonstrate front end alignment procedure

11. TASK: Aligh Rear End

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, align rear axle. Vehicle readings must be within manufacturer's specifications.

III.C STEERING SYSTEMS

ENABLING OBJECTIVES:

11.1 Demonstrate safety precautions when working under a vehicle
11.2 Identify several cars that have an adjustable rear axle
11.3 Locate rear axle adjustment points
11.4 Demonstrate use of the equipment necessary to align the vehicle rear axle

12. TASK: Remove And Replace Steering Wheel

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace the steering wheel. The steering wheel should be aligned, bolt tightened, horn connected and there should not be any damage done to steering wheel cover.

ENABLING OBJECTIVES:

12.1 Demonstrate safety precautions when working inside a vehicle
12.2 Demonstrate use of a steering wheel puller
12.3 Identify thread and bolt size on a specific vehicle so that the appropriate puller can be used
12.4 Demonstrate proper removal and replacement of steering wheel and related parts

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IV. ELECTRICAL SYSTEMS

A. Electrical Theory

1. Electron Theory
2. Series Circuits
3. Parallel Circuits
4. Voltage
5. Amperage
6. Ohm

IV.A ELECTRICAL THEORY

1. TASK: Electron Theory

PERFORMANCE OBJECTIVE: Identify the electron theory and its relation to the overall need for understanding the electrical systems. Pass a test with 85% proficiency.

ENABLING OBJECTIVES:

1.1 Identify the atom
1.2 Identify static electricity
1.3 Explain basically simple rules of behavior
1.4 Explain electricity in motion
1.5 Explain atomic structure and conductivity
1.6 Explain the electrons
1.7 Explain semiconductors, diodes, and transistors

2. TASK: Series Circuits

PERFORMANCE OBJECTIVE: Identify series circuits and define their characteristics. Pass a written test with 80% proficiency.

ENABLING OBJECTIVES:

2.1 Demonstrate safety when working with electricity
2.2 Connect two light bulbs in series
2.3 Connect a switch in series
2.4 Explain how resistance is figured in series circuits

3. TASK: Parallel Circuits

PERFORMANCE OBJECTIVE: Identify parallel circuits and define their characteristics. Pass a written test with 80% proficiency.

ENABLING OBJECTIVES:

3.1 Demonstrate safety when working with electricity
3.2 Connect two light bulbs in parallel with a battery
3.3 Connect a switch in parallel circuit
3.4 Explain how resistance is figured in parallel circuits

4. TASK: Voltage

PERFORMANCE OBJECTIVE: Identify voltage and the effect that it has on current flow. Pass an appropriate test with 80% proficiency.

ENABLING OBJECTIVES:

4.1 Demonstrate safety when working with electricity
4.2 Demonstrate the results on a light bulb by changing voltage source from 12 to 6 volts
4.3 Explain how to use a volt meter

IV.A ELECTRICAL THEORY

5. TASK: Amperage

PERFORMANCE OBJECTIVE: Identify amperage and what affects it in an electrical circuit. Pass an appropriate test with 80% proficiency.

ENABLING OBJECTIVES:

5.1 Demonstrate safety when working with electricity
5.2 Develop a complete circuit
5.3 Read the amperage correctly using a amp gauge

6. TASK: Ohm

PERFORMANCE OBJECTIVE: Identify ohm and what affect it has on a complete circuit. Pass an appropriate test with 80% proficiency.

ENABLING OBJECTIVES:

6.1 Demonstrate safety when working with electricity
6.2 Explain how ohm's law works
6.3 Explain when changing a resistor the amperage flow will change
6.4 Demonstrate how to use a ohm meter when reading resistance

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IV. ELECTRICAL SYSTEMS

B. Batteries

1. Visual Inspect Batteries For Servicability
2. Inspect Battery Electrolyte Level
3. Test Battery With Hydrometer
4. Perform Battery Load Test
5. Service Or Clean Battery Post, And Cable Connections
6. Measure Negative And Positive Voltage Drop
7. Remove And Replace Battery Cables
8. Charge Battery

IV.B BATTERIES

1. TASK: Visual Inspect Batteries For Servicability

PERFORMANCE OBJECTIVE: Given a battery visual inspect for any external damage cracks, warpage and overcharge.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions while working around battery
1.2 Define a damage from a crack
1.3 Define what is meant by warpage
1.4 Define what evidence would resault from overcharge
1.5 Defeine why a battery should be cleaned top and across and around battery

2. TASK: Inspect Battery Electrolyte Level

PERFORMANCE OBJECTIVE: Given a battery, inspect the electrolyte level. When completed the level should be within the battery manufacturer's specifications. Avoid spillage.

ENABLING OBJECTIVES:

2.1 Define electrolyte and state its chemical makeup in a lead/ acid battery
2.2 Demonstrate safety precautions while working around battery electrolytes
2.3 Demonstrate removal of battery cell caps

3. TASK: Test Battery With A Hydrometer

PERFORMANCE OBJECTIVE: Given a hydrometer, battery, and specifications, check the stat of charge of a battery using a hydrometer. The readings should be taken and compared to book specs. The operation will determine the serviceability of the battery at this point.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions when working with battery acid
3.2 Define what is meant by specific gravity
3.3 Demonstrate removal and replacement of battery cell caps
3.4 Demonstrate the use of the battery hydrometer

4. TASK: Perform Battery Load Test

PERFORMANCE OBJECTIVE: Given a battery, its capacity rating, an amp meter and carbon pile, test the battery voltage in conjunction with amperage draw. The operator should be able to compare the readings to specs and determine if the battery is servicable.

IV.B BATTERIES

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when working with battery test
4.2 Explain amperage draw versus voltage drop
4.3 Demonstrate how to hook up a volt meter, ammeter, and carbon pile
4.4 Define voltage, amperage and carbon pile
4.5 Demonstrate proper use and reading of test equipment

5. TASK: Service Or Clean Battery Post, And Cable Connections

PERFORMANCE OBJECTIVE: Given a battery and proper tools, service and clean a battery, posts and cable connections. When completed, the cleanliness will be checked, along with bolt security, and whether grease or protective lubricant was used in the proper places.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when working with liquid storage batteries
5.2 Discuss the advantages and/or disadvantages of a side mount battery over a top mount battery
5.3 Describe the proper sequence of removal of battery connections
5.4 Explain problems with battery connectors
5.5 Describe a periodical battery post and connector maintenance requirement
5.6 Demonstrate use of protective coating on connections

6. TASK: Measure Negative And Positive Voltage Drop

PERFORMANCE OBJECTIVE: Given a vehicle, volt meter, and necessary tools, measure negative and positive voltage drop. When completed, the recorded voltage drop will be checked against specifications. Safety and care of the volt meter will be checked also.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions when working with batteries
6.2 Explain how a volt meter works
6.3 Demonstrate handling and use of volt meter
6.4 Describe voltage drop as found using test equipment

7. TASK: Remove And Replace Battery Cables

PERFORMANCE OBJECTIVE: Given a vehicle and necessary tools, remove and replace battery cables. Upon completion, cable routing, tightness, and length will be checked.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions when working with lead acid storage batteries
7.2 State the reason for disconnecting the negative cable <u>first</u> before starting any electrical work

IV.B BATTERIES

7.3 Describe the "one" wire electrical system used on most automobiles
7.4 Demonstrate care and caution needed to handle battery cable connectors and battery posts
7.5 Demonstrate the use of protective coating on connections

8. TASK: Charge Battery

PERFORMANCE OBJECTIVE: Given a weak battery and a charger, charge the battery. Before charging, determine correct polarity, electrolyte level, rate of charge, and remove vent caps if appropriate.

ENABLING OBJECTIVES:

8.1 Demonstrate safety procedures when charging a battery
8.2 Discuss how the charger is to be operated and handled
8.3 Define polarity
8.4 Demonstrate test for battery charge
8.5 Explain why vent cap must be removed while charging a regular battery
8.6 Explain charging of a maintenance free (sealed top) battery

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IV. ELECTRICAL SYSTEMS

C. Starting Systems

1. Test Starter Control Circuit
2. Test Starter Amperage And Voltage Drop
3. Remove And/or Replace Starter Solenoid
4. Remove And Replace Starter
5. Rebuild Starter

IV.C STARTING SYSTEMS

1. TASK: Test Starter Control Circuit

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, test starter control circuit. When completed, the following items should have been checked:

1. Battery connections
2. Ignition switch operation
3. Solenoid operation
4. Neutral control switch

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions when testing starter electrical circuits
1.2 Describe how the starting system is controlled by the ignition switch and neutral safety switches
1.3 Inspect battery connections, test ignition switch voltage, and solenoid operation
1.4 Describe results of circuit and test examination
1.5 Demonstrate proper starter circuit operation

2. TASK: Test Starter Amperage Draw And Voltage Drop

PERFORMANCE OBJECTIVE: Given a vehicle, volt/amp tester, service manual, and necessary tools, test starter amperage and voltage drop. The recorded readings will be compared to specifications. Care for the volt/amp tester will be observed.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions when performance testing starter circuits
2.2 Explain how many amps are drawn for different engines and different temperatures of an engine
2.3 Explain test equipment operation and "hook-up"
2.4 Describe results of test and explain problems discovered

3. TASK: Remove And/or Replace Starter Solenoid

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, and parts, remove, repair, or replace starter solenoid. When compelted all terminals must be secured and all bolts tightened.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions while working on electrical circuits
3.2 Discuss the different types starter solenoids and where they are located on the vehicle
3.3 Define solenoid and explain how the unit functions

3.4 Demonstrate the procedure for repairing a solenoid
3.5 Demonstrate careful handling of electrical connections and equipment
3.6 Demonstrate proper operation of circuit by starting the vehicle

4. TASK: Remove And Replace Starter

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, and new part, remove and replace a starter. When completed all electrical terminals must be secured and all bolts tightened.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions while working on electrical circuits and gear trains
4.2 Demonstrate safety and proper method of disconnecting the battery
4.3 Demonstrate the procedure for removing and replacing a given starter
4.4 Test starter for proper operation upon completion

5. TASK: Rebuild Starter

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, test equipment, and necessary parts, rebuild starter. When completed, all bolts should be tight, brushes properly seated, commutator serviced correctly, and bushings or bearings replaced and lubricated.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions while working on electrical units
5.2 Explain the importance of commutator and bushing condition
5.3 Explain brush to commutator contact
5.4 Inspect all parts for burning, wear and general condition
5.5 Describe type and points for lubrication
5.6 Demonstrate use of test equipment
5.7 Demonstrate bench test for proper operation

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IV. ELECTRICAL SYSTEMS

D. Charging System

1. Test Alternator Maximum Output
2. Test Voltage Regulator Operation
3. Remove And Replace Alternator
4. Rebuild Alternator
5. Remove And Replace Voltage Regulator (Internal And External)
6. Inspect, Remove And Replace, And Adjust Alternator Belt

IV.D CHARGING SYSTEMS

1. TASK: Test Alternator Maximum Output

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, volt amp tester, and necessary tools, test alternator for maximum output. When completed, the recorded output should be compared to specifications. Safety precautions must be observed as the vehicle engine is running.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions when using test equipment on an operating engine
1.2 Explain the different ways that manufacturers check maximum output of their alternators
1.3 Demonstrate use of and proper "hook-up" of alternator test equipment
1.4 Explain result of "low" output of alternator
1. Explain result of "high" output of alternator

2. TASK: Test Voltage Regulator Operation

PERFORMANCE OBJECTIVE: Given a vehicle, volt meter, service manual, and necessary tools, test voltage regulator operation. When completed, the recorded readings should be compared to specifications. Proper safety and care of the volt meter must be observed.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions when servicing a running engine
2.2 Explain the purpose and function of the charging system and voltage regulator
2.3 Describe test results as found at idle speed
2.4 Describe test result as found at "road" speed
2.5 Explain reasons for the difference in test results
2.6 Demonstrate use of test equipment, when properly connected for test

3. TASK: Remove And Replace Alternator

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace alternator. When completed, all bolts and connections must be tight, the alternator must be aligned properly and the belt tight.

IV.D CHARGING SYSTEMS

ENABLING OBJECTIVES:

3.1 Explain the reason for disconnecting the negative connection of the battery before starting this task or any electrical circuit work
3.2 Demonstrate proper caution in disconnecting alternator wiring harness and connections
3.3 Inspect drive belts and all electrical connections for condition
3.4 Describe different types of alternators
3.5 Demonstrate proper drive belt tension and test for output

4. TASK: Rebuild Alternator

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools and parts, rebuild an alternator. When completed, all bolts must be tight, proper points lubricated, and terminals secure.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when working inside a unit
4.2 Explain how the brushes are loaded and installed in an alternator
4.3 Describe how to service the slip rings
4.4 Demonstrate bearing checks and lubrication
4.5 Describe position of parts (housing) on reassembly
4.6 Demonstrate test for internal excessive "drag" and proper output of unit

5. TASK: Remove And Replace Voltage Regulator (Internal Or External)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace the voltage regulator. All bolts, screws, and terminal connections must be secure. Check wires for proper positioning.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when working on electrical circuits
5.2 Explain which systems have internal and which systems have external regulators and how the procedures for removing or replacing them differ
5.3 Identify external regulator
5.4 Demonstrate removal and replacement of external regulator and careful handling of electrical connections
5.5 Identify internal regulator type of alternator
5.6 Demonstrate removal and replacement of alternator and replacement of internal regulator

IV.D CHARGING SYSTEMS

6. TASK: Inspect, Remove And Replace, And Adjust Alternator Belt

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, inspect, remove, replace, and adjust the alternator belt. Check belt condition for serviceability, tension, and bolts for tightness.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions
6.2 Explain the importance of belt tightness on an alternator equipped vehicle
6.3 Inspect drive belt for cracks and excessive wear
6.4 Demonstrate use of drive belt tension gauge "hand" method test

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IV. ELECTRICAL SYSTEMS

E. Component Service

1. Follow Schematic Diagram
2. Identify Wire Gauge And Color Identification
3. Splice Wires And Ends
4. Isolate Opens, Grounds And Shorts
5. Test/Remove/Replace Switches, Circuit Breakers, And Fuses
6. Test/Remove/Replace Lights, Sockets, And Connections
7. Test And Repair Or Replace Turn Signal Unit
8. Adjust Headlights
9. Adjust, Repair Or Replace Back-Up Light Circuit
10. Test And Repair Horn Circuit
11. Repair Or Replace Fuse Block Assembly
12. Replace Chassis Wiring
13. Test And Replace Gauge And Sending Unit Assembly
14. Remove And Replace Electrical Switch
15. Test Electrical Components And/or Resistors

IV.E COMPONENT SERVICE

1. TASK: Follow Schematic Diagram

PERFORMANCE OBJECTIVE: Given any electrical circuit, wiring schematic book, trace the circuit and identify the component in it.

ENABLING OBJECTIVES:

1.1 Explain how to locate a given automobile in the schematic manual
1.2 Explain how to identify components
1.3 Explain how a schematic is used
1.4 Explain how to care for wire schematic book or manual

2. TASK: Identify Wire Gauge And Color Identification

PERFORMANCE OBJECTIVE: Given a vehicle and circuit manual, identify the proper size wire and the purpose for color coding. Pass an appropriate test with 80% proficiency.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Demonstrate proper size wire to carry amperage of system
2.3 Demonstrate proper color code method

3. TASK: Splice Wires And Ends

PERFORMANCE OBJECTIVE: Given a vehicle with a known ground, short or open circuit, the proper tools, and service manual, locate and repair the condition the student will achieve accuracy, speed, and safety on the task.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions while working on an electrical circuit
3.2 Demonstrate use of test equipment
3.3 Demonstrate the proper type of repair necessary to correct problem
3.4 Demonstrate test for proper operation of repaired circuit

4. TASK: Isolate And Repair Open, Ground, Or Short Circuits In Wiring

PERFORMANCE OBJECTIVE: Given a vehicle with a known ground, short, or open circuit, the proper tools, and service manual, locate and repair the condition. The student should achieve accuracy, speed, and safety on the task.

IV.E COMPONENT SERVICE

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions while working on an electrical circuit
4.2 Discuss how the whole wiring system of a vehicle can be broken down into individual electrical systems and the problem isolated to a particular system
4.3 Demonstrate use of test equipment
4.4 Identify the circuit and type of electrical failure
4.5 Demonstrate the type of repair necessary to correct problem
4.6 Demonstrate test for proper operation of repaired circuit

5. TASK: Test/Remove/Replace Circuit Breakers, Switches, And Fuses

PERFORMANCE OBJECTIVE: Given any circuit breaker, switch or fuse, test for serviceability by using an ohm meter, test light or volt meter.

ENABLING OBJECTIVES:

5.1 Explain how an ohm meter, volt meter, or test light can be used to determine current flow
5.2 Explain care in handling electrical circuits and test equipment
5.3 Demonstrate ohm meter on equipment being tested
5.4 Define circuit breaker and its function
5.5 Define switches and their functions

6. TASK: Test/Remove/Replace Lights, Sockets And Connections

PERFORMANCE OBJECTIVE: Given a power supply, service manual, volt/ohm meter or test light, test lights, sockets or connections for proper operation. When completed, the mechanic should identify every terminal and explain when each terminal has continuity with the power supply side.

ENABLING OBJECTIVES:

6.1 Explain the terms "opn" and "closed" circuits
6.2 Demonstrate use of V.O.M.
6.3 Explain complete circuit of unit tested
6.4 Define continuity and power supply side
6.5 Explain safety precautions

7. TASK: Test And Repair Or Replace Turn Signal Units

PERFORMANCE OBJECTIVE: Given a vehicle with an inoperative signal light system, service manual and necessary tools, test and repair to manufacturer's specifications.

IV.E COMPONENT SERVICE

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions while testing, repairing or replacing electrical units
7.2 Explain the operation of the signal light system
7.3 Identify the units of signal light systems
7.4 Demonstrate use of proper test equipment

8. TASK: Adjust Headlights

PERFORMANCE OBJECTIVE: Given a vehicle and proper tools and equipment, align headlights to manufacturer's specifications. Time and accuracy must be achieved.

ENABLING OBJECTIVES:

8.1 Demonstrate safety precautions while adjusting headlights
8.2 Identify light type and gauge adapter used
8.3 Demonstrate proper specifications to use
8.4 Align headlights to manufacturer's specifications

9. TASK: Adjust, Repair Or Replace Back-Up Light Circuit

PERFORMANCE OBJECTIVE: Given a vehicle and proper tools, test and repair/replace back-up light system's components.

ENABLING OBJECTIVES:

9.1 Demonstrate safety precautions while testing, repairing or replacing back-up light systems
9.2 Explain operation of the back-up light system
9.3 Demonstrate the use of test equipment
9.4 Demonstrate proper repairs

10. TASK: Test And Repair Horn Circuit

PERFORMANCE OBJECTIVE: Given a vehicle and proper tools and equipment, test horn circuit diagnose/repair/replace units in the horn system to manufacturer's specifications.

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions while testing, repair or replacing electrical horn circuit
10.2 Explain the operation of the horn system
10.3 Identify unit of the horn system
10.4 Demonstrate use of proper test equipment

IV.E COMPONENT SERVICE

11. TASK: Remove And Replace Fuse Or Circuit Breaker

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, proper tools and replacement parts, remove and replace a fuse or circuit breaker unit. When accomplished, the unit will be securely snapped in place and in proper alignment. There should be no evidence of corrosion at terminal points.

ENABLING OBJECTIVES:

11.1 Demonstrate safety precautions while working on electrical unit
11.2 Discuss the similiarity between the function and operation of a fuse or circuit breaker
11.3 Explain the safety involved in removing a glass fuse from a fuse panel
11.4 Identify circuit breaker, fuse and fusible link

12. TASK: Replace Wiring Or Wiring Harness

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools and parts, replace wiring or wiring harness. Neatness, length, and size of wire must be correct.

ENABLING OBJECTIVES:

12.1 Demonstrate safety precautions when working on "live" electrical circuits
12.2 Explain how wire is sized for its particular function
12.3 Explain how fuses/circuit breakers must match wire size and current demand
12.4 Demonstrate care in handling electrical units and surrounding parts
12.5 Demonstrate care in making electrical connections to proper units

13. TASK: Test And/or Replace Gauge And Sending Unit Assembly

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and proper tools, test and/or replace a gauge and sending unit assembly. When completed, any malfunction will have been detected, and the condition of wires, lines, and gauges noted. Time and accuracy must be achieved.

ENABLING OBJECTIVES:

13.1 Demonstrate safety precautions while testing or replacing electrical units
13.2 Explain the operation of the sending unit and gauge assembly
13.3 Identify the sending unit and its receiving gauge
13.4 Explain function of specific gauge assembly

IV.E COMPONENT SERVICE

13.5 Explain function of dash warning lights
13.6 Demonstrate use of proper test equipment for indicator assembly test
13.7 Inspect all wiring or manual gauge lines appropriate to assembly being tested

14. TASK: Remove And Replace Electrical Switch

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace switch. When completed, all terminals must be secure, wires routed correctly and correct wire on correct terminal. The switch must be securely mounted and adjusted as needed. Examples of these switches include the following:

1. Headlight switch
2. Dimmer switch
3. Fan switch
4. Turn signal switch
5. Back-up light switch
6. Park/neutral switch
7. Brake light switch

ENABLING OBJECTIVES:

14.1 Explain the important of care to be taken with delicate switches or wiring
14.2 Discuss examples of units and other components that must be removed on some vehicles in order to remove and replace switches in the dash area
14.3 Demonstrate removal and replacement of a switch
14.4 Demonstrate safety precautions

15. TASK: Test Electrical Components And/or Resistors

PERFORMANCE OBJECTIVE: Given an electrical component and/or resistor, service manual, power supply, and necessary toolds, test components and/or resistors as follows:

1. Fan motor
2. Headlight
3. Horn
4. Wiper motor
5. Power seat/window motor
6. Starter
7. Windshield-washer motor
8. Power antenna
9. Cigarette lighter
10. Radio/tape deck

IV.E COMPONENT SERVICE

ENABLING OBJECTIVES:

15.1 Explain the purpose and use of the unit
15.2 Demonstrate safety precautions while testing a unit that has "hot" current being applied to it
15.3 Demonstrate method of testing to be performed on a specific unit
15.4 Identify unit to be tested at its location

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Competency Modules

V. FUEL SYSTEM

A. Fuel Pump

1. Test Fuel Pump Volume, Pressure And Vacuum

2. Remove And Replace A Fuel Pump

V.A FUEL PUMP

1. TASK: Test fuel pump volume, pressure and vacuum

PERFORMANCE OBJECTIVE: Given a vehicle, tools, equipment and service manual, measure fuel pump volume, pressure and vacuum. Check pressure and volume at specified time and RPM. Perform a vacuum test on the suction side of the fuel pump. Pressure, volume and vacuum will meet manufacturer's specifications orthe deviations will be explained and recommendations made.

ENABLING OBJECTIVES:

1.1 Demonstrate safety procedures
1.2 Describe fuel pump design and operation
1.3 Describe fuel pump types and possible locations
1.4 Describe "vapor lock"
1.5 Demonstrate test equipment connections and test procedure

2. TASK: Remove and replace a fuel pump

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, necessary parts and a manufacturers service manual, remove and replace the fuel pump. When completed, the pump should perform to specifications with no fuel or oil leaks and fuel lines should be correctly routed.

ENABLING OBJECTIVES:

2.1 Demonstrate safety procedures
2.2 Discuss the advantages and disadvantages of mechanical versus electric fuel pumps
2.3 Describe the operation of a two-line fuel pump
2.4 Describe the operation of a three line fuel pump
2.5 Demonstrate fuel pump replacement procedure
2.6 Inspect for leaks and line routing

Big Bend Community College
Automotive Mechanics
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V. FUEL SYSTEM

B. Carburetor

1. Inspect, Service And/or Replace Carburetor Air Cleaner
2. Inspect, Service And/or Replace A Fuel Filter
3. Repair And/or Replace Fuel Lines And Hoses
4. Test Engine Vacuum
5. Adjust Carburetor Idle Mixture And Speed Using A Tach/dwell Meter
6. Remove, Replace And/or Adjust A Carburetor Float
7. Remove And Replace A Carburetor
8. Rebuild A Carburetor
9. Adjust Carburetor Using An Exhaust Gas Analyzer
10. Inspect, Clean And Adjust A Carburetor Choke Assembly

V.B CARBURETOR

1. TASK: Inspect, Service And/or Replace Carburetor Air Cleaner

PERFORMANCE OBJECTIVE: Given a vehicle, proper tools, shop manual, and necessary filter elements, inspect, service or replace carburetor air cleaner. Inspect main filter element and the positive crankcase ventilation system filter (if used).

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions
1.2 Explain the purpose and operation of the air filter element
1.3 Explain the purpose of the crankcase ventilation system filter (if used)
1.4 Describe the service procedure for each
1.5 Demonstrate how to test an air filter element

2. TASK: Inspect, Service And/or Replace An Automotive Fuel Filter

PERFORMANCE OBJECTIVE: Given a vehicle with a fuel filter, the necessary filter element, tools and service manual replace the fuel filter element. The filter should be installed allowing fuel to flow through the element in the proper direction with no visible fuel leaks.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Describe the function of a fuel filter
2.3 Explain the purpose of a bypass valve
2.4 Identify all the possible locations of fuel filters and the service procedure for each type
2.5 Demonstrate fuel filter element replacement and check for leaks

3. TASK: Repair And/or Replace Fuel Lines And Hoses

PERFORMANCE OBJECTIVE: Given a vehicle and the necessary tools, repair or replace fuel lines and hoses. Raise car on hoist and inspect fuel lines and hoses from the fuel tank to the carburetor. Repair or replace fuel lines and hoses as required. All lines will be free of restrictions, leaks, or other defects.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions
3.2 Explain hose and line selection
3.3 Demonstrate line repair procedure for metal or flexible lines
3.4 Inspect all flexible lines weather and heat cracks
3.5 Discuss problems of air or fuel leaks on the suction side of pump
3.6 Discuss dangers of fuel leaks on pressure side of pump

V.B CARBURETOR

4. TASK: Test Engine Vacuum

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and tools, and necessary test equipment, test engine vacuum. Upon completion, the manifold and carburetor vacuum should have been checked. Any diviation from the manufacturers specifications should be explained.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions
4.2 Explain the difference in carburetor and manifold vacuum
4.3 Locate possible areas of vacuum leaks
4.4 Explain the importance of manifold vacuum
4.5 Demonstrate test equipment connection procedures and operation

5. TASK: Adjust Carburetor Idle Mixture And Speed Using A Tach/dwell Meter

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, adjust carburetor idle mixture. When completed the proper curb idle, speed, high idle speed, and side balancing should be within factory specifications.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions
5.2 Explain the purpose and operation of the anti-dieseling solenoid
5.3 Explain the operation of the idle, intermediate and main fuel metering circuits
5.4 Demonstrate test equipment connection procedures and operation
5.5 Describe idle limiter caps
5.6 Demonstrate carburetor adjustment techniques

6. TASK: Remove, Replace And/or Adjust A Carburetor Float

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, manufacturer's service manual, and necessary replacement parts, remove carburetor air horn and replace or adjust a carburetor float to manufacturer's specifications. The needle and seat must control fuel flow from the complete "off" to the complete "open" position with no internal or external fuel leaks.

V.B CARBURETOR

ENABLING OBJECTIVES:

6.1 Demonstrate safety precaution
6.2 Explain the operation of a float circuit in a carburetor
6.3 Discuss the advantages or disadvantages of a cellular versus a brass float
6.4 Describe problems caused by a "heavy" or "sinking" float
6.5 Demonstrate float replacement and adjustment

7. TASK: Remove And Replace A Carburetor

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, a manufacturer's service manual and necessary replacement parts, remove and replace the carburetor. When completed, the carburetor should be adjusted to specifications and perform with no air or fuel leaks. Linkage, lines and connections should all be secure and properly adjusted.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions
7.2 Discuss the advantages or disadvantages of carburetor replacement rather than carburetor rebuild
7.3 Demonstrate carburetor replacement
7.4 Demonstrate all the carburetor adjustments
7.5 Inspect for leaks and check for proper operation and adjustment

8. TASK: Rebuild A Carburetor

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, a manufacturer's service manual and necessary replacement parts, rebuild a carburetor. When completed, the carburetor shall have all internal and external adjustments to manufacturer's specifications and should perform with no internal or external leaks.

ENABLING OBJECTIVES:

8.1 Demonstrate safety precautions
8.2 Describe the importance of the carburetor cleaner solution
8.3 Demonstrate disassembly and assembly procedures including parts inspection and adjustment
8.4 Demonstrate cleaning and drying procedures
8.5 Locate the six carburetor circuits of the carburetor and describe the function of each component
8.6 Explain staged carburetion
8.7 Define primary and secondary bores

V.B CARBURETOR

9. TASK: Adjust Carburetor Using An Exhaust Gas Analyzer

PERFORMANCE OBJECTIVE: Given an operating vehicle, service manual, tools and necessary test equipment, adjust carburetor using an exhaust gas analyzer. When completed, the hydrocarbon and carbon monoxide readings should be within specifications or possible causes noted.

ENABLING OBJECTIVES:

9.1 Demonstrate safety precautions
9.2 Explain several adjustments that can be made on a carburetor
9.3 Explain the readings obtained by an exhaust gas analyzer
9.4 Identify problems that could cause a high hydrocarbon reading
9.5 Identify problems that could cause a high carbon monoxide reading
9.6 Explain idle limiter caps
9.7 Compare readings with a manufacturer's service manual

10. TASK: Inspect, Clean And Adjust A Carburetor Choke Assembly

PERFORMANCE OBJECTIVE: Given a vehicle, an approved cleaning fluid, necessary tools and equipment, and a manufacturer's service manual, clean and adjust the choke assembly. When completed, the choke should be clean, move and operate freely and at desired temperature ranges. The choke pull-off should be properly adjusted and check for operation as well as the "high" idle and curb idle speeds.

ENABLING OBJECTIVES:

10.1 Demonstrate safety precautions
10.2 Explain choke circuit operation
10.3 Describe the adjustment procedure used with different types of chokes
10.4 Demonstrate proper cold setting of an automatic choke
10.5 Demonstrate proper adjustment of the choke pull off mechanism
10.6 Demonstrate the proper procedure to adjust "high" idle
10.7 Demonstrate the proper procedure to adjust "curb" idle

Big Bend Community College
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V. FUEL SYSTEM

C. Emissions Control System

1. Test And/Or Repair Manifold Heat Riser Assemblies
2. Test Automotive Exhaust Emissions
3. Adjust Idle Mixture Using The Propane Enrichment Procedure
4. Test And/or Repair PCV System
5. Test And/or Repair A Thermostatic Air Cleaner System
6. Test And/or Repair An Exhaust Gas Recirculation System
7. Test And/or Repair An Evaporative Emission Control System
8. Test And/or Repair An Air Injection Reactor System
9. Test And Adjust An Idle Solenoid

V.C EMISSIONS CONTROL SYSTEM

1. TASK: Test And/or Repair Manifold Heat Riser Assemblies

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, and an approved high temperature lubricant, service or repair manifold heat controls. The valve checked and serviced or replaced as necessary. When operating, the heat riser valve will close when cold, and will open when the engine is accelerated or hot.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions
1.2 Explain the operation of the manifold heat riser system
1.3 Describe how to check for a plugged crossover passage
1.4 Explain the reason for carburetor heat
1.5 Identify manifold heat control valve components

2. TASK: Test Automotive Exhaust Emissions

PERFORMANCE OBJECTIVE: Given an operating vehicle, service manuals, tools, and necessary test equipment, perform an exhaust emission test. When completed, the student should have checked the following:

1. Hydrocarbon output
2. Carbon monoxide output
3. Emission output and operation of the idle circuit, intermediate circuit, power circuit and accelerator pump operation

The findings should be compared to book specifications and any deviation explained relating to possible causes.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions while working on a "live" engine in a closed garage
2.2 Demonstrate proper analyzer connections
2.3 Explain the purpose of the fuel system components
2.4 Explain the operation of the different carburetor circuits
2.5 Describe the causes of hydrocarbons
2.6 Describe the causes of carbon monoxide
2.7 Describe the operation of the PCU, EGR, air pump and catalytic converter systems

3. TASK: Adjust Idle Mixture Using The Propane Enrichment Procedure

PERFORMANCE OBJECTIVE: Given a vehicle using propane idle adjustment, tools, necessary equipment and a manufacturer's service manual, perform a propane idle adjustment. The idle speeds should be at the suggested manufacturer's specifications or deviations explained.

V.C EMISSIONS CONTROL SYSTEM

ENABLING OBJECTIVES:

3.1 Demonstrate safety procedures
3.2 Explain the procedure used to perform a propane idle test
3.3 Describe the reasons for checking engine performance first
3.4 Demonstrate test equipment connection procedures and operation
3.5 Perform a propane idle adjustment

4. TASK: Test and/or repair PCV system

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, manufacturer's service manual, test and/or repair a PCV system.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions
4.2 Explain the difference between an "open" and a "closed" PCV system
4.3 Explain the operation of a "road draft tube"
4.4 Describe the operation and need for a PCV system
4.5 Demonstrate manifold vacuum test for system operation

5. TASK: Test and/or repair thermostatic air cleaner

PERFORMANCE OBJECTIVE: Given a vehicle with thermostatic air cleaner, necessary tools and equipment and a manufacturer's service manual, check the operation of the thermostatic air cleaner. The performance check should include:

1. Thermostatic valve operation (to manufacturer's specifications)
2. Damper assembly position in cold air mode
3. Damper assembly position in hot air mode
4. Air pipe for proper connections

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions
5.2 Identify and explain the operation of the components of the heated air intake system
5.3 Explain the need for the heated air intake system
5.4 Explain atomization and vaporization
5.5 Demonstrate the test procedures

V.C EMISSIONS CONTROL SYSTEM

6. TASK: Test and/or repair an exhaust gas recirculation (EGR) valve operation

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, manufacturer's service manual, test and service the EGR valve, and the system components operation. When service is completed, the valve should perform as specified with no internal or external exhaust gas leaks.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions
6.2 List the three gases that form exhaust emissions
6.3 Explain the purpose of the EGR system
6.4 Describe the effect of exhaust gases on the combustion process
6.5 Demonstrate EGR system test

7. TASK: Test and/or repair the evaporative emission control system

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, manufacturer's service manual, test and service the evaporative emission control system. The test should include:

1. System operation
2. Hoses and tubes for routing and leaks
3. Canister filter inspection and/or replacement

When completed, the evaporative emission control system should function to manufacturer's specifications with no vacuum or fuel leaks present.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions
7.2 Describe the purpose of the fuel evaporation system
7.3 Identify the fuel evaporation system components and their operation
7.4 Identify sources of fuel evaporation
7.5 Demonstrate filter replacement
7.6 Demonstrate a system performance test

8. TASK: Test and/or repair an air injection reactor system

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment and manufacturer's service manual, test the operation and performance of the air injection reactor (AIR) system. Students will compare their readings to specifications and determine if the system is functioning properly.

V.C EMISSIONS CONTROL SYSTEM

ENABLING OBJECTIVES:

8.1 Demonstrate safety procedures
8.2 Explain the purpose of the air system
8.3 Locate the components of the air system and explain the function of each
8.4 Explain the operation of a pulse air system
8.5 Explain what can cause a "backfire."
8.6 Demonstrate a system function test
8.7 If test results differ from the manufacturer's readings, identify the problem or component

9. TASK: Test and adjust an idle solenoid

PERFORMANCE OBJECTIVE: Given a vehicle, tools and equipment, and manufacturer's service manual, test and adjust a idle solenoid. When the adjustment is completed, the solenoid operation will be within manufacturer's specifications.

ENABLING OBJECTIVES:

9.1 Demonstrate safety procedures
9.2 Explain the purpose of the idle solenoid
9.3 Demonstrate solenoid operation and test rpm specifications with air conditioning (if possible) on and/or solenoid energized
9.4 Demonstrate adjustment to obtain rpm specifications

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VI. POWER TRAINS

A. Clutch

1. Road Test And Diagnose Clutch
2. Adjust Manual Clutch
3. Adjust Hydraulic Clutch
4. Remove And Replace Clutch Linkage Or Cable
5. Remove And Replace Or Rebuild A Slave Or Master Cylinder On Hydraulic Clutch
6. Remove And Replace A Clutch Disc And Pressure Plate
7. Remove And Replace Clutch Release Bearing (Throw Out Bearing)
8. Remove, Replace, And Service Pilot Bearing Or Bushing
9. Measure Flywheel Runout
10. Remove And Replace Flywheel
11. Remove And Replace Ring Gear

VI.A CLUTCH

1. TASK: Road Test And Diagnose Clutch

PERFORMANCE OBJECTIVE: Given a automobile with a clutch problem, diagnose by test drive and recommend proper repair.

ENABLING OBJECTIVES:

1.1 Explain power flow of the clutch
1.2 Explain the purpose of all parts within the clutch
1.3 Demonstrate safety precautions
1.4 Demonstrate operational test to diagnose clutch operation, noise or malfunction

2. TASK: Adjust Manual Clutch

PERFORMANCE OBJECTIVE: Given a vehicle with manual clutch, service manual, and necessary tools adjust the clutch as needed. The free travel will be compared to the manufacturer'specifications, all nuts and fasteners must be correrctly installed and the return spring must work properly.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Explain the purpose for clutch free travel
2.3 Describe adjustment procedure
2.4 Demonstrate properly adjusted clutch action in relation to transmission shift

3. TASK: Adjust Hydraulic Clutch

PERFORMANCE OBJECTIVE: Given a vehicle with a hydraulic clutch, necessary tools and manual, adjust the clutch. Adjusting mechanism will be checked for security, free travel will be compared to specifications, and proper return spring positioning will be checked.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions
3.2 Explain advantages and disadvantages of a hydraulic clutch as compared to a manual clutch
3.3 Identify adjusting mechanism of hydraulic clutch unit
3.4 Identify clutch master cylinder and slave cylinder
3.5 Inspect fluid level of system and correct if low
3.6 Demonstrate proper adjustment and test operation of units

4. TASK: Remove And Replace Clutch Linkage Or Cable

PERFORMANCE OBJECTIVE: Given a manual clutch equipped vehicle, service manual, and necessary tools, remove and replace any linkage or cable must be properly routed, not bind on operation, and all nuts and fasteners secured.

VI.A CLUTCH

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions
4.2 Explain differences between the linkage and cable type operated clutch
4.3 Identify parts to be removed and replaced on specific vehicle
4.4 Demonstrate proper adjustment and operational test

5. TASK: Remove And Replace Or Rebuild A Slave Or Master Clinder On A Hydraulic Clutch

PERFORMANCE OBJECTIVE: Given a required vehicle, manual, and necessary tools remove, replace or rebuild the slave or master cylinder. The cylinder should be bled, have no leaks, and all nuts, bolts, and bleeder screws secure.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when handling hydraulic fluid
5.2 Explain how to bleed a hydraulic clutch
5.3 Demonstrate removal and disassembly of the specific unit
5.4 Inspect all parts, replace all worn or damaged parts
5.5 Demonstrate reassembly and installation of specific unit
5.6 Demonstrate bleeding of hydraulic system and test for proper operation

6. TASK: Remove And Replace A Clutch Disc And Pressure Plate

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace the clutch disc and pressure plate. Pressure plate bolts will be checked for torque and the pilot bushing should be lubricated or replaced as necessary.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions when working under a raised vehicle
6.2 Describe how a clutch operates
6.3 Explain the purpose of "free travel" in a clutch
6.4 Demonstrate removal of clutch assembly and related components
6.5 Identify the throw-out bearing and the piolt bushing; explain the functions of each
6.6 Inspect all clutch assembly parts for wear and damage
6.7 Demonstrate lubrication, assembly and adjustments of clutch parts and related components
6.8 Demonstrate operational test

VI.A CLUTCH

7. TASK: Remove And Replace Clutch Release Bearing (Throw-Out Bearing).

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and tools, remove and replace the clutch release bearing. The free travel must be within specifications and all nuts and bolts tightened properly.

ENABLING OBJECTIVES:

7.1 Demonstrate safety precautions when working under a raise vehicle
7.2 Explain the purpose of the clutch release bearing
7.3 Demonstrate removal of the manual transmission
7.4 Demonstrate removal, inspection and replacement of the release bearing
7.5 Identify the release bearing fork and explain the function
7.6 Demonstrate adjustment and test for correct operation

8. TASK: Remove, Replace, And Service Pilot Bearing Or Bushing.

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and tools, remove, replace and service pilot bearing or bushing. The bushing or bearing should be pressed in the correct distance, greased (if required) and all nuts and bolts tightened correctly.

ENABLING OBJECTIVES:

8.1 Demonstrate safety precautions
8.2 Explain the purpose of a pilot bushing or bearing and distinguish between serviceable and non-serviceable bearings
8.3 Inspect bearing for excessive wear or damage
8.4 Demonstrate removal and replacement and lubrication of pilot bearing and related parts
8.5 Define a pilot shaft

9. TASK: Measure Flywheel Runout

PERFORMANCE OBJECTIVE: Given a flywheel, service manual, necessary tools, and a dial indicator, measure flywheel runout for serviceability.

ENABLING OBJECTIVES:

9.1 Demonstrate safety precautions
9.2 Describe how a dial indicator is used to measure runout
9.3 Demonstrate the testing procedure of flywheel runout
9.4 Inspect condition of flywheel surface and starter ring gear

10. TASK: Remove And Replace A Flywheel.

PERFORMANCE OBJECTIVE: Given a vehicle, service manual and necessary tools, remove and replace the flywheel. Bolt torque will coincide with manufacturer's specifications and locking tabs must be correctly secured.

VI.A CLUTCH

ENABLING OBJECTIVES:

10.1 Demonstrate safety procedures when working under a raised vehicle
10.2 Demonstrate removal of a flywheel and related parts
10.3 Inspect the flywheel for clutch surface wear and starter ring gear damage
10.4 Demonstrate replacement of a flywheel, torquing of bolts, and locking procedure of bolts

11. TASK: Remove And Replace Flywheel Ring Gear.

PERFORMANCE OBJECTIVE: Given a flywheel, service manual, and necessary tools, remove and replace the flywheel ring gear.

ENABLING OBJECTIVES:

11.1 Demonstrate safety precautions
11.2 Explain methods of removing the old ring
11.3 Demonstrate how to replace starter ring gear
11.4 Inspect installed ring gear for alignment

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VI. POWER TRAINS

B. Manual Transmission

1. Diagnose Manual Transmission Problems
2. Adjust Shift Linkage
3. Remove And Replace Manual Transmission
4. Rebuild Manual Transmission
5. Lubricate A Manual Transmission
6. Identify Type of Transmission

VI.B MANUAL TRANSMISSION

1. TASK: Diagnose Manual Transmission Problems

PERFORMANCE OBJECTIVE: Given a vehicle, with a problem, service manual, test drive and diagnose the problem in the transmission and recommend proper repairs needed.

ENABLING OBJECTIVES:

1.1 Explain power flow of transmission gears
1.2 Explain the purpose of all parts within a manual transmission
1.3 Demonstrate safety precautions
1.4 Demonstrate operational test to check gear positions for operation, noise or malfunction

2. TASK: Adjust Shift Linkage

PERFORMANCE OBJECTIVE: Given a vehicle with a manual treansmission, service manual, proper tools, adjust the external shift linkage. When adjustments are completed, the shifter should operate smoothly, appropriate gears should be able to be selected, and all nuts and fasteners must be installed correctly.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Explain how a manual transmission shift is accomplished
2.3 Identify adjustment points
2.4 Demonstrate proper shift pattern for specific vehicle when adjustments are made

3. TASK: Remove And Replace Manual Transmission

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and necessary tools, remove and replace the manual transmission. The transmission and mount bolts will be secure, the linkage and wires should be properly connected and the driveshaft should be correctly installed and secured.

ENABLING OBJECTIVES:

3.1 Demonstrate how to safely raise a vehicle for transmission removal
3.2 Describe the use of a transmission jack
3.3 Demonstrate removal and replacement of manual transmission and related components
3.4 Demonstrate operational test of transmission after proper linkage adjustments
3.5 Explain safety precautions

VI.B MANUAL TRANSMISSION

4. TASK: Rebuild Manual Transmission

PERFORMANCE OBJECTIVE: Given a transmission, service manual and tools, rebuild a manual transmission. All bolts will be torqued, no leakage will be present, and the transmission must operate smoothly. All needle bearings and thrust washers must be correctly installed.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precaustion
4.2 Explain power flow of the manual transmission in all gears
4.3 Demonstrate how to use grease to hold needle bearings in position during assembly
4.4 Demonstrate disassembly of manual transmission
4.5 Inspect gears and related parts for wear and damage
4.6 Demonstrate reassembly of gears and examine operation

5. TASK: Lubricate A Manual Transmission

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, and tools, lubricate the manual transmission. Fluid level, filler plug tightness, and type of lubricant must be correct.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when working under a raised vehicle
5.2 Explain what grease (by weight) should be used in the transmission of a specific vehicle
5.3 Identify the lubricating point and check fluid level

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VI. POWER TRAINS

C. Drive Lines

1. Perform An Operational Test And Inspect The Drive Line

2. Remove And Replace Universal Joints

3. Remove And Replace Drive Shaft

4. Remove And Replace Center Support And Bearing

VI.C DRIVE LINES

1. TASK: Perform An Operational Test And Inspect Drive Line

PERFORMANCE OBJECTIVE: Given a vehicle and necessary shop manual and tools, perform an operational test and inspect the drive line. The following items should be checked.

1. Drive shaft
2. Universal joints
3. Support bearings
4. Rear axle supports, hangers and springs
5. Transmission mount
6. Lug nuts

Any movement or loose parts should be noted.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions while working under a raised vehicle
1.2 Identify: drive shaft, universal joints, support bearings, rear axle supports, transmission mount, and lug nuts
1.3 Demonstrate a complete drive line inspection
1.4 Identify discrepancies found and recommend the repairs needed

2. TASK: Remove And Replace Universal Joints

PERFORMANCE OBJECTIVE: Given a vehicle, manufacturer's service manual, proper parts, and the necessary tools, remove and replace the universal joints.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions
2.2 Explain the operation of a universal joint
2.3 Explain the operation of a universal joint press
2.4 Describe the methods used to secure universal joints
2.5 Demonstrate the removal and replacement of the universal joints

3. TASK: Remove And Replace A Drive Shaft

PERFORMANCE OBJECTIVE: Given an automobile, manufacturer's service manual, the proper parts, and the necessary tools, remove and replace a drive line assembly.

VI.C DRIVE LINES

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions while working under a raised vehicle
3.2 Explain the operation of the slip yoke
3.3 Explain universal joint phasing
3.4 Describe the methods used to secure drive shaft assemblies
3.5 Demonstrate removal and replacement of the drive shaft

4. TASK: Remove And Replace Center Support And Bearing

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, the proper parts, and the necessary tools, remove and replace the center support and bearing.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions while working under a raised vehicle
4.2 Explain when and why a center support and bearing is used
4.3 Demonstrate drive shaft removal and support bearing inspection
4.4 Demonstrate removal and replacement of the center support from the drive shaft
4.5 Demonstrate universal joint phasing
4.6 Demonstrate drive shaft assembly installation

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VI. POWER TRAINS

D. Differential

1. Service Differential Assembly
2. Replace Differential Pinion Seal
3. Remove And Replace Axle Seal
4. Remove And Replace Axle Bearing
5. Rebuild Differential Assembly
6. Remove And Replace Final Drive Assembly

VI.D DIFFERENTIAL

1. TASK: Service Differential Assembly

PERFORMANCE OBJECTIVE: Given a vehicle, manufacturer's service manual, proper lubricant, and necessary tools, service the differential. When complete, the filler plug must be secure, and proper lubricant used as well as the unit be filled to the proper level.

ENABLING OBJECTIVES:

1.1 Demonstrate safety precautions when working on a raised vehicle
1.2 Explain the types of lubes and additives used in conventional and positraction units
1.3 Demonstrate how to remove old lubricant
1.4 Demonstrate how to determine the proper fluid level and fill differential
1.5 Inspect for leakage of differential assembly

2. TASK: Replace Differential Pinion Seal

PERFORMANCE OBJECTIVE: Given a vehicle, manufacturer's service manual, proper parts and lubricant, and the necessary tools, remove and replace the differential pinion seal. The yoke shall be inspected for wear, and the differential reassembly with the proper bearing preload.

ENABLING OBJECTIVES:

2.1 Demonstrate safety precautions when working under a raised vehicle
2.2 Demonstrate drive shaft assembly removal
2.3 Demonstrate final drive yoke and pinon seal removal
2.4 Discuss repair or replacement of yoke due to wear or grooves
2.5 Discuss pinion bearing preload
2.6 Demonstrate installation of the pinion seal and yoke assembly
2.7 Demonstrate operational test

3. TASK: Remove And Replace Axle Seal

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, the proper parts, and the necessary tools, remove and replace axle and inner axle seal. When completed, there must be no axle grease seal leakage and all nuts and bolts tight.

ENABLING OBJECTIVES:

3.1 Demonstrate safety precautions when working on a raised vehicle
3.2 Explain the different ways that axles are retained
3.3 Demonstrate the use of an axle puller

VI.D DIFFERENTIAL

3.4 Demonstrate removal and replacement of axle and inner axle seal
3.5 Demonstrate rear axle fluid level filling
3.6 Inspect for operation, leaks and bolt torque when completed

4. TASK: Remove And Replace Axle Bearing

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, the proper tools, and the necessary tools, remove and replace an axle bearing. When completed, the axle bearing and its retainer must be pressed on and in the proper position. All nuts and bolts must be properly torqued.

ENABLING OBJECTIVES:

4.1 Demonstrate safety precautions when working on a raised vehicle
4.2 Explain the different ways that axles are retained
4.3 Demonstrate the use of an axle puller
4.4 Demonstrate removal and replacement of axle assembly
4.5 Demonstrate inspection of axle bearing and related parts while removed from housing
4.6 Demonstrate how to safely use a hydraulic press to remove and replace an axle bearing
4.7 Inspect for operation, leaks and bolt torque when completed

5. TASK: Rebuild Differential Assembly

PERFORMANCE OBJECTIVE: Given a differential, manufacturer's service manual, the proper parts, and the necessary tools, remove the differential assembly and recondition. When completed, the backlash, and gear tooth pattern, and bearing preload must meet manufacturer's specifications and all nuts and bolts secure.

ENABLING OBJECTIVES:

5.1 Demonstrate safety precautions when working under a raised vehicle
5.2 Demonstrate removal and replacement of differential assembly
5.3 Identify special tools and equipment
5.4 Demonstrate removal of gears and inspect for wear and/or damage
5.5 Explain how to use a dial indicator
5.6 Demonstrate how to check gear tooth pattern of the ring gear assembly
5.7 Discuss the difference between adjusting the differential that was shims and one that has a screw-type adjustment
5.8 Discuss bearing preload and a compression sleeve
5.9 Demonstrate reassembly and adjustments at gear teeth, back lash and bearing preload.
5.10 Demonstrate operational test

VI.D DIFFERENTIAL

6. TASK: Remove And Replace Final Drive Assembly (Integral Or Conventional Type)

PERFORMANCE OBJECTIVE: Given a vehicle, service manual, the proper parts, and the necessary tools, remove and replace differential assembly. When completed, there must be no grease leaks, the brakes must function properly, and all nuts and bolts must be properly torqued.

ENABLING OBJECTIVES:

6.1 Demonstrate safety precautions when working under a raised vehicle
6.2 Demonstrate removal and replacement of drive shaft
6.3 Demonstrate removal and replacement of the final drive assembly
6.4 Demonstrate brake bleeding operation using a pressure bleeder or another person to assist
6.5 Demonstrate emergency brake adjustment
6.6 Demonstrate how to check differential fluid level
6.7 Demonstrate operational test for proper function